JANUARY, 1950

METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS
FOUNDED 1903

Developments During 1949 • Gold Plating • Electropolishing • Chrome Plating with Radioactive Tracers

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Read & Pass On

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JANUARY-DECEMBER, 1950

(Compiled by W. A. Raymond, Eng. Editor and I. Oquendo, Edit. Ass't.)

In this index all material that appeared in the January through December 1950 issues of *Metal Finishing* is listed according to subject matter, with cross references where required. Following each listing will be found a letter indicating the manner in which the material was published, as follows:

(S)—Shop Problem
(R)—Recent Development
(P)—Patent
(M)—Manufacturers' Literature
(B)—New Book
(D)—Engineering Data Sheet
(L)—Letters to the Editor

Any reference not followed by a letter was a feature article. The numbers in the right-hand column refer to the month and page numbers; **6**-85 means June issue, page 85, etc.

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COMING SOON

A comprehensive article on the proper care and maintenance of motor generators for long and efficient life in the plating room.

An analysis of the trends in abrasive polishing and buffing, including the use of contoured back-up wheels for belt polishing.

New methods for the rapid analysis of chrome plating baths, including the determination of contaminating impurities and the analysis of anode alloys.

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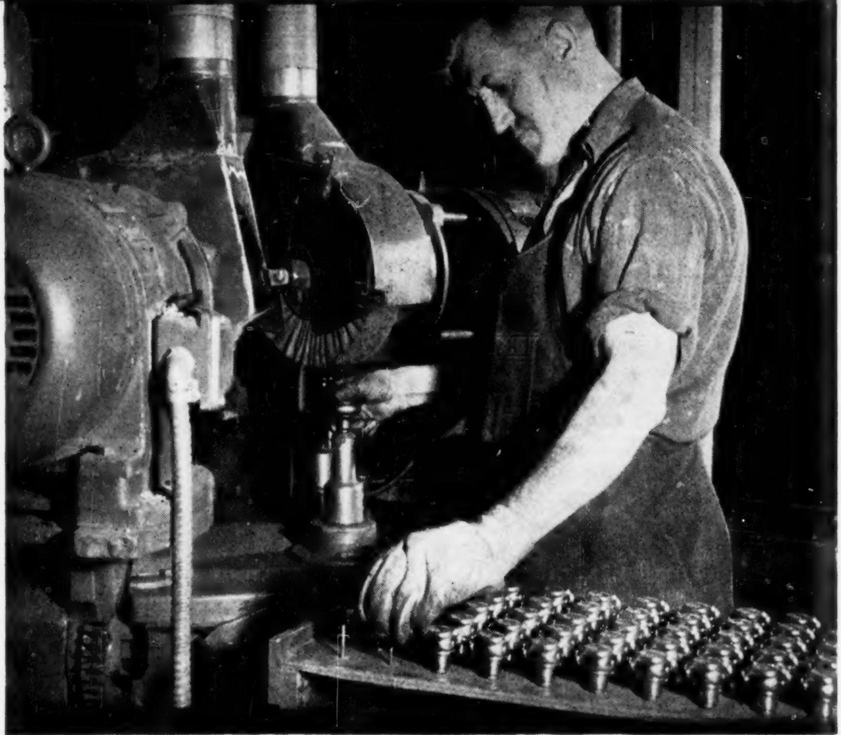

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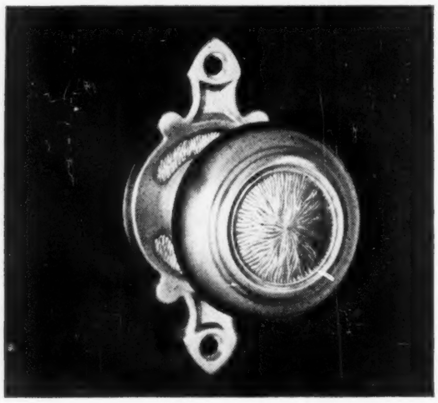

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The Year Ahead

This is the season when almost everyone attempts a serious appraisal of the probable business conditions and prospects for the coming year or so. This activity has become a part of the irrepressible nature of the American business man, and a commendable, if somewhat hazardous habit.

Experts can easily be found who will predict anything and everything from a boom to a bust during the next twelve months, but always with reservations and a whole host of intangible "ifs" which serve to point out the complex interlocking nature of the American business picture, but otherwise offer so little specific information as to make it impossible to form any definite conclusions for a given branch of industry, the electroplating industry being no exception.

This may really be a fortunate thing, as it would be hard to conceive of any "expert" who could possibly know as much about the details of your particular business as you do yourself, and his averaging out of a large number of conditions could lead to disastrous results in certain specific cases. It is small consolation indeed to know that the average level of business activity will be higher or lower than in previous years if it is your competitor who is getting more than his share of that business while you are going broke. Operating a business successfully has always been a hard job and, with present government trends, will continue to demand unceasing effort and a firm adherence to sound business fundamentals, if a safe course is to be negotiated.

The coming year will be one in which economy and efficiency of all operations must be paramount, from manufacturing on through to the selling and merchandising. For the electroplating industry, this means wider use of automatic equipment and higher quality finishes. To prove that we are only human, we will disregard our own advice above and predict a general activity level on a par with 1949, but that's as far out as we want to stick our neck. The fact that one of the largest users of electroplated products, the automotive industry, is planning the biggest production year in its history, makes it difficult to feel otherwise.

One thing you can be sure of, however, is our earnest wish to you all for

A Happy and Prosperous New Year

W. A. Raymond

Important Developments in Metal Finishing During 1949

By Walter A. Raymond, *Managing Editor*

IF ANY one thing could be singled out as being indicative of the past year's accomplishments in the metal finishing field, as well as pointing out a trend for the coming years, it would be the pronounced drift away from the traditional hand operations of grinding, polishing, buffing, and coloring. Developments in chemical and electropolishing, bright plating, periodic - reverse plating, levelling, etc., are all aimed at the elimination of part if not all, of the preliminary or afterplate surfacing operations. Even in cases where wheel methods cannot be supplanted, the wider use of semi and fully automatic polishing and buffing machinery is gradually making the skilled polisher less of a necesity than ever. Some of the surfacing equipment introduced in recent months is nothing short of ingenious in its diversity.

It is a strange feeling to be able to say that shortages of chemicals, materials, and skilled labor were virtually non-existent. In fact, about the only shortages noticeable were in the "Cash Available" departments, the average level of business being some 15-20% below last year's peak, in line with the general reduction in activity in the metal working industry.

Job shop plating, for the most part, was at a low level, which is normal for an industry which depends to a large extent on "overflow" production from regular manufacturing operations.

Periods of highly competitive endeavor, in which we now find ourselves more deeply entrenched, always tend to promote greater efficiency down the line, and the following paragraphs will review the more important happenings which have been instrumental in improving the efficiency of metal finishing operations as well as the quality of plated products.

Theoretical

Scientific history is replete with instances where man has been able to produce a given effect at will, even to the point of developing commercial processes around it, without knowing the fundamental mechanism responsible for the effect. Such is the case with "bright" plating.

In an attempt to verify the commonly stated belief that the brightness of an electrodeposit depends to a large extent on the grain orientation of the deposited metal, *Smith, Keeler*, and *Read*[1] made a rather extensive X-Ray diffraction study of experimental and commercial bright nickel baths, using a wide range of organic and metallic brighteners. To avoid previous preferred orientation of the base metal and its surface, a hot-rolled steel was used with an electropolished surface. Their results did not show any relation between brightness and preferred orientation. The fact that these investigators recognized the necessity for electropolishing their specimens was significant, as a whole series of articles by *Jacquet*[2] pointed out the important affect of the extreme surface condition of the base metal on subsequent electrodeposits and surface properties. In view of Jacquet's studies, it is apparent that much of the previous data obtained on mechanically polished surfaces should be re-evaluated.

Mears[3] investigated the popular theory of passivity of oxide films, and suggested other mechanisms as being more important in accomplishing this effect. His analysis proposes that 1) reduction in open circuit potential differences between the local anodes and cathodes, 2) increased anodic or cathodic polarization, and 3) a combination of these factors, are more important than oxide films in promoting passivation.

The effect of supersonic waves on electrodeposition was studied by *Ishiguro* and *Haramai*[4], but no major differences were noted in chrome plating except a slight improvement in hardness.

The formation of pits in electrodeposits was explained in an interesting article by *Calderon*[5]. While no new theories were advanced, this discussion did point out the several general causes, with suggestions for their elimination.

An interesting treatment of the calculations for thorough rinsing was given by *Kushner*[6], who derived formulas for calculating the required number of rinse tanks, taking into account the dissolved solids, volume of drag-over, and flow rates of the rinses.

Blast Cleaning

With an eye on the elimination of the pressing problem of waste pickle liquor disposal, many firms were considering the wider use of blast cleaning methods as an alternate procedure. Some of the inherent disadvantages of blast cleaning with standard equipment and grits, such as uncertain control of surface finish and self destructiveness of the equipment, have been

overcome by newer liquid abrasive media blasting processes[7]. This method is now being used for fine surface finishing of dies, molds, etc., before chrome plating, and for controlled erosion and burring of accurately machined parts. The development of stainless steel shot[8] for cleaning stainless steel, and copper shot for copper base alloys[9] has eliminated the problem of imbedding iron or abrasive particles in the surfaces of the treated parts.

Polishing and Buffing

As would be expected during a period when expensive production operations were being watched with a very critical eye, the tendency toward the use of completely automatic equipment for polishing and buffing operations showed a decided spurt during the past year. Wider use of abrasive belts was very much in evidence, with considerable interest being shown in the application of heavy canvas-backed belts which could be re-coated many times[10]. Along with this went the development of coated polishing grains[11] and more flexible cements[12] for greater bonding strength and increased flexibility for contour polishing. There was also a continued development and use of water-dispersable buffing compositions to the point where practically every supplier now includes this type in their general line of compounds.

A practice which seems destined to become more important in the coming years is the use of pre-finished sheets and strips, which eliminate a good part of the polishing operations required on the final parts after forming, etc. Considerably wider use of this method was in evidence during the past year, and several machinery manufacturers have recognized this trend by adding sheet finishing machines to their line of abrasive polishing equipment.

Pickling and Acid Dipping

Willan[13] reported on the relative merits of sulfuric and hydrochloric acids for pickling iron and steel from a practical viewpoint, pointing out that for some applications the lower first cost of sulfuric acid could often be offset by the cost of heating for comparable pickling speed and by the undesired formation of less-soluble iron sulfates prior to galvanizing, tinning, or enameling. Another important point brought out in his discussion was the fallacy in reporting consumption of acid as pounds of acid used per ton of steel pickled. Pickling being concerned with surface area only, this latter figure is the only true one on which to base comparisons.

Acid dips prior to plating were the subject of a round-table discussion at the annual AES Convention; the preferred acid for ferrous metals was dilute hydrochloric, with sometimes a small amount of hydrofluoric acid being added when treating sand-blasted steel, or cast iron parts. A patent[14] was granted for an acid pre-treatment for aluminum which was claimed to promote better anodized films.

Alkaline Cleaning

The field of alkaline cleaning prior to plating remained relatively inactive during the past year, at least as far as any major developments are concerned. However, a great deal of energy was expended in practically every plating department to see that the maximum effectiveness was obtained in the use of the wide variety of commercial cleaners available. The fact that a large percentage of plating failures still stems from improper cleaning is more the result of inadequate application than inadequate materials.

A relatively new problem, that of properly cleaning porous powdered metal parts for plating, was discussed by *Graham* and *Anderson*[15]. Important results can be expected from the research currently being conducted by several of the large cleaner firms who are using radioactive tracer techniques to study the cleaning mechanism, but at present the work is incomplete and inconclusive. Surface-active (wetting) agents were used to a greater extent than heretofore in alkaline cleaners as an effective aid to soil removal and free rinsing. *Reich* and *Snell*[16] discussed di-phase metal cleaners, which have not as yet taken much of a hold in the plating industry, but which will be more widely used as their advantages over stable-emulsion type cleaners become better known.

Electropolishing—Chemical Polishing

One of the most active phases of the metal finishing field has been in the development and application of chemical and electrochemical methods for producing a high lustre on parts, in an attempt to eliminate some or all of the more costly wheel coloring and buffing operations. The idea of producing a high lustre on metals by means of chemical solutions has been an intriguing one for many years, and the past year has

Figure 1—Blast cleaning with liquid abrasive sludges is rapidly assuming an important place in the cleaning and burring of precision parts such as dies and molds, where dimensional accuracy must be maintained.

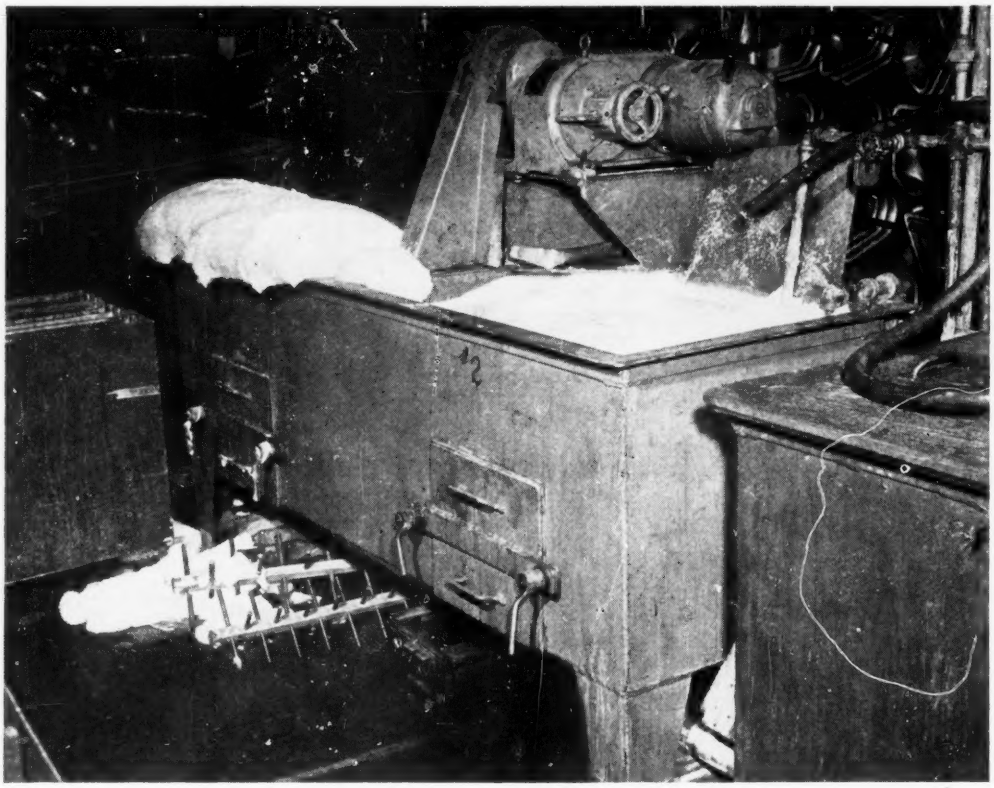

Figure 2—Burring and surface smoothening to fine finishes on precision aircraft parts is now being done in barrel equipment such as pictured at left.

brought forth several important improvements in techniques and solutions.

In a series of important articles, *Jacquet*[31, 32] described the conditions under which perchloric-acetic polishing baths could safely be used, and also reviewed the latest advances in electropolishing baths. *Michel*[33] reported in considerable detail the effect of stirring, method of racking, auxiliary anodes, etc., on the polish obtained on various shaped articles in commercial baths.

Aluminum

With the ever increasing use of aluminum alloys showing no signs of abatement, it is natural that a great deal of attention was focused on baths and methods for producing lustrous surfaces on these alloys, and several more firms introduced chemical polishing baths[17, 18]. A patent[19] was granted in England for a chemical brightening bath consisting of 27.5% phosphoric acid, 52.5% sulfuric acid, 20% water (all by volume) to be used at 110° C for 3 minutes. This treatment was followed by a rinse in a 3% chromic-sulfuric or 3% phosphoric-chromic acid bath. The process is claimed to be suited for shot-blasted or polished surfaces.

Several patents were granted for electropolishing baths for aluminum. One[20] consisted of phosphoric acid (42%), sulfuric acid (8%), water (17%) and ethylene glycal monoethyl ether (33%). Another[21] was made up of phosphoric acid (40-90%), water (up to 50%), boric acid (1.5%) and oxalic acid (3%), with the addition of a small amount of a heavy metal salt, such as lead oxide. A third[22] covered a bath of phosphoric acid—water—carbinals (such as n-butyl alcohol or amyl alcohol). This bath was also claimed usable for polishing stainless steel, copper, brass, zinc, and nickel.

Brass

A new method for chemically polishing brass was announced by *Battelle Institute*[23]. The process is also claimed useful for copper, nickel-silver, monel, nickel, and aluminum. *Axtell*[24] described a commercial installation and bath for electropolishing of small brass parts, giving composition of the bath and operating details.

Stainless Steel-Carbon Steels

Several firmly established commercial processes for stainless steel electropolishing found wider applications, and several patents were granted for new baths. *Field*[25] obtained a patent for an alternating current process using concentrated nitric acid and water, and *Charlesworth* patented a process[26] using organic amino compound additions to a phosphoric-sulfuric bath, which was claimed to eliminate etching and pitting at low current densities. A bath for polishing carbon steels described by *Eilander* and his associates[27], was composed of sulfuric and phosphoric acids.

Other Metals

Gray[28] further described a commercial process for electropolishing silver, including plated holloware, in simple cyanide baths. *Gall* and *Miller*[29] developed and patented a sulfuric-hydrofluoric bath for electropolishing tantalum, as well as a hydrofluoric-hydrochloric acid bath for the same metal[30].

Plating

The trend in present day plating practice is to let the plating operation itself accomplish as much of the

overall finishing job as it can, the ultimate dream being the possibility of running the unpolished parts through the plating cycle and obtaining a bright, smooth, lustrous, finished article. The past year has seen ample evidence that significant strides are being made in that direction, and we can expect to see some very important results along these lines in the near future, as every possible copper and nickel formulation is studied for its "levelling power" as well as its bright plating potentialities. In addition to normal plating procedures, periodic reverse current techniques are expected to play an important part in the realization of the ultimate goal.

Copper Plating

Strangely enough, the acid copper baths seem to be making a strong comeback in the decorative plating field where they were once thought to be obsolete. Considerable interest is also being maintained in the acid baths in the electrotyping and electroforming trade.

Two new proprietary bright copper plating baths, one acid and one cyanide, were placed on the market during the year. These are described more fully under Commercial Developments. *Young* and *Nobel*[34] developed a phosphoric acid bright copper plating bath that should find some use. Current densities of 50 asf and higher were possible, although the throwing power was somewhat lower than that of a sulfate acid copper bath. *Jernstedt*[35] described a new cyanide bath using inorganic brighteners exclusively for use with periodic reverse current, which is claimed to give exceptional "levelling" power and bright deposits in thicknesses of .040". In contrast to most bright deposits, Jernstedt's bath was said to give ductile, soft deposits, or hard deposits as desired.

A factor not usually associated with copper plating, that of hydrogen embrittlement, was shown by *Zapffe* and *Haslem*[36] to be as prevalent with copper plating as it is in cadmium or chrome plating, especially on stainless steel. Mild steel is not as seriously affected, however.

A number of patents were granted for copper plating baths. *Brown*[37] patented an acid fluoborate bath (bright) using acetyl cyanamide as an addition agent. *Keller*[38] obtained a patent on a sulfate acid bath containing molasses and thiourea additions. *Willson* and *Ellis*[39] received a patent grant for a cyanide copper bath with an acyl thiophene addition. *Max*[40] patented an acid sulfate bath containing triethanolamine, and with *Vance*[41] was granted a patent for a similar bath containing triisopropanolamine.

Nickel Plating

As with copper, one of the most sought-after effects of nickel plating is the smoothing, or "levelling" action on base metals which have not been finished with the finest grain abrasives. This levelling does not necessarily go with bright plating, as was pointed out by *Willson* and *Du Rose*[42], who showed that a semi-bright bath had better smoothing action than a typical bright plating bath or a regular Watts bath. Other characteristics of this semi-bright bath are further described in separate articles[43, 44], which point out a 50% reduction in plating time and a 25% increase in the buffing output in an actual operating installation.

Evidence of the thinking in terms of extremely fast plating of nickel is seen in the study by *Wesley*[45] and his associates, wherein current densities up to 4000 amps/ft^2 (.001" in 16 *seconds*) were used. High electrolyte flow rates are required, but even at a flow rate of 10 ft/min a current density of 400 amps/ft^2 pro-

Figure 3 — Rapid methods for analyzing plating baths for impurities and addition agents require colorimetric techniques for speed and accuracy.

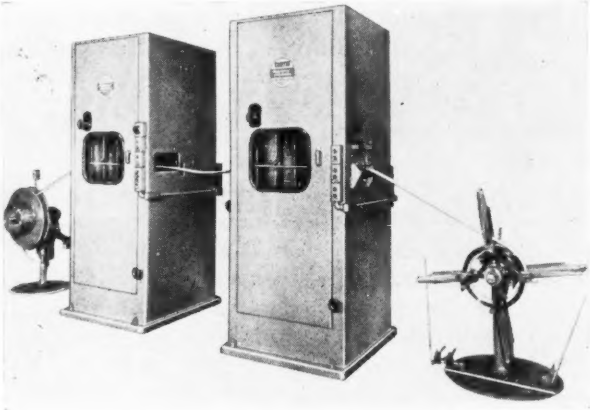

Figure 4—Prefinishing of metals in strip form before forming operations is being used to eliminate many of the final polishing operations. Machines of the type pictured above permit economical rough and fine polishing of coiled strip stock.

duced good deposits. Limiting factors to commercial utilization of such high plating currents would lie in the inability to provide sufficient voltage, solution circulation, cooling of the bath, anode-cathode distances, etc.

Ledford[46] described the rapid making of hard electrotypes with good ductility from a modified cobalt-nickel bath.

Several important patents were granted during the year for nickel plating. Two British patents were granted for methods of plating ductile adherent nickel on zinc alloys[47] and on nickel[48]. The first involved the use of a pH 5.3-6.2 tartaric acid-nickel chloride bath: the second claimed a good bond for nickel over nickel in a 2 minute reverse current treatment in a 90-200 gm/1 sulfuric acid bath containing 2-10 gm/1 cupric sulfate, followed by a regular nickel plating. Several patents were issued to *Brown* for a bright plating bath consisting of nickel sulfate, chloride, and fluoborate with an addition of 2-nitrovinyl benzene sulfonic acid[49], another[50] for a bath consisting of nickel sulfate, chloride, sulfamate and fluoborate with organic addition agents for brighteners; another[51] for a sulfamate chloride, sulfate bath, with sulfonate organic additions. *Hoffman*[52] also obtained a patent for a nickel bath containing sulfones.

Chrome Plating

Both decorative and hard chrome plating came in for much study during the year, with several interesting and important aspects being noted. In addition to the commercial introduction in this country of a new high-speed self-regulating chrome process (see under Commercial Developments) a British patent was granted to *Berger*[53] for a hydrofluosilicic-ammonium molybdate chrome bath which was claimed to have a much higher cathode efficiency, wider bright plating range, and much higher throwing power than the conventional chromic-sulfuric type of solution.

A number of worthwhile contributions to the technique of chrome plating were made last year. *Muller*[54] and his co-workers concluded that no benefits are derived from super-imposing an A.C. current during chrome plating, contrary to an early patent by Hausner (German Patent 153029-1927). *Patrie*[55] described two pickling baths claimed to be useful for chrome plating directly over aluminum. One is composed of 400 gm. Nickel Chloride, 2° Baume (500 ml/l) hydrochloric acid solution containing 4 gm/1 of Manganous Sulfate.

Zmihorski[56] concluded, as a result of shear-adhesion tests, that for best adhesion hard chrome deposits should be not over .0025" thick. If thicker deposits must be used, anodic etching in Sulfuric Acid should be used before plating.

The fatigue limit of chrome plated steels was studied by *Bastien* and *Popoff*[57] and *Logan.*[58] Bastien and Popoff showed that the detrimental affect of chrome plating on fatique limit was due to the fissured network, which could not be relieved by heat treatment for 3 hours at 200° C. Logan found that stress relieving the plated parts above 400° C increased the fatigue limit, due to the relief of stresses accompanying the rupture or flow of the chromium plating.

Hosdowitch,[59] reporting on the hardness of chromium deposits, stated that the hardness was definitely related to the appearance; matte deposits being softest, bright deposits hard, and burnt deposits still harder (scratch hardness), but softer by abrasion hardness standards. Current density, temperature, and chromic-catalyst ratios had less correlation with scratch hardness than did the appearance.

Tin Plating

During the year restrictions on the use of tin were eased and tin became more easily available, resulting in more and heavier tin plating of sheets for canned foods, and of food handling equipment. Several of the largest steel mills expanded their electrolytic tinning installations.

A new anode for tin plating was introduced and patented[60, 61]. Incorporating 1% of aluminum, it is claimed to permit operation at much higher current densities with high efficiency.

Two new patents for tin plating baths were granted. One[62] covered sulfonic acid baths, the other[63] was for an addition agent of polyalkylene oxide of high molecular weight.

Zinc Plating

Bright zinc plating, especially barrel plating, and the use of bright dips after regular zinc plating, have shown an expanded use for the past few years. A comprehensive list of brightening agents for zinc plating was published[64], giving details on 74 different agents.

Several patents relating to zinc plating were granted during the last year. *Bair*, *Benner*, and *Walker*[65] patented a bright cyanide bath containing cyanamide and formalydehyde; *Chester* and *Reisinger*[66] patented a bright cyanide bath containing piperonyl aldehyde and aldonic acid as brighteners; another with zinc aldonate[67], and one with gluconic acid and chromium compounds[68]. *Stareck* and *Passalacqua*[69] obtained a patent on a bright zinc bath made up of pyrophosphates and benzaldehyde.

Lead Plating

Aside from several patents issued, there is very little to report regarding lead plating. The usual coated sheet and chemical handling equipment applications for lead remained the principle use, with the uses for plated bearings, of course, much less than during the war years. The patents covered an acetate plating bath[70], a method for closing up pin holes in electroplated lead coatings[71], a nitrate plating bath[72].

Cadmium Plating.

While cadmium plating continued to enjoy wide popularity because of its color and easy application, the high cost of the metal has caused considerable inroads by zinc and other types of plating on the field formerly partial to cadmium. This is discussed elsewhere in this article.

One patent[73] was granted for cyanide baths containing addition agents of aldonic acid and its derivatives.

Silver Plating

Selenium additions to cyanide silver baths for producing bright deposits have apparently gained some ground during the past year, eliminating to a great extent the uncertainties in using carbon bisulfide and other organic brighteners. One high speed, bright plating formula was recently patented[74] using potassium selenite. *Wilson*[75] discussed the relative merits of both disulfide and selenium brighteners from a practical viewpoint.

Plating on Aluminum

Since the development of the zincate processes for plating on aluminum, this metal is being much more widely used as a base for decorative plating, a trend which will continue to grow. The development of baths for depositing starting films other than zinc will be a factor in this growth. *Heiman*[76] discussed such immersion baths for zinc, cadmium, tin, and copper as undercoats for subsequent plating. *Knapp*[77] disclosed an electrolytic-zincate treatment for promoting good adhesion on strong aluminum alloys which should be applicable to a wide range of uses. A short cathodic treatment at the end of the initial immersion period is all that is required. *Keller* and *Zelley*[78] pointed out that the conditioning treatment used before the immersion zincate dip is important in determining the weight of coating obtained.

A patent[79] was obtained by *McCoy* for a method for plating nickel directly on aluminum. An oxidizing (anodic) step was involved, followed by plating nickel from an acid bath. *Arent*[80] patented a process for getting a deposit of antimony on aluminum alloys by immersion.

Rare Metal Plating

One patent was granted in this field for a sulfamate indium bath[81] while deposition of germanium was developed by *Fink* and *Dokras.*[82] *Holt* and *Netherton*[83] developed a citric acid and also a sulfuric acid bath for rhenium which produced shiny, adherent coatings. An investigation by *Seim* and *Holt*[84] failed to obtain deposits of tantalum from any of the baths heretofore proposed for that metal. Pure molybdenum (not alloyed) plating baths were developed by *Ksycki* and *Yntema*[85]. Bright, adherent deposits were also obtained.

Alloy Plating

The field of alloy plating has always been one of potential greatness and vigorous research, but with very little commercial realization. The past year was no exception. One rather important trend was noticeable, however, in the wider use of plated coatings of lead-tin alloys as an aid to soldering[86, 87]. Mixed fluoborate solutions seem to be the preferred means of obtaining a good deposit. A bath consisting of fluoborate and sulfamate, with organic addition agents, for depositing lead-tin alloys was also the subject of a recent patent[88].

A commercial installation for tin-zinc alloy plating was discussed by *Miller* and *Cuthbertson*[89]. The economics of the process would seem to favor it over cadmium, with a comparable corrosion resistance and appearance, but with better solderability.

Plated coatings of the "heavy" metals having high strength, hardness, and resistance to oxidation continued to be a fertile field for investigators, with *Seim* and *Holt*[90] developing citrate baths for molybdenum alloys with iron, nickel, and cobalt.

Graham[91, 92] and his co-workers experimented with various acid chloride baths for depositing precious metal alloys of silver-gold-platinum. They were able to obtain usable deposits of silver-platinum, silver-palladium, silver-rhodium, silver-iridium, silver-ruthenium, silver-osmium, gold-platinum, platinum-palladium, and silver-platinum-palladium. A number of

Figure 5—Levelling power and smoothening effect of various plating baths is studied as a means of reducing the amount of preliminary surface preparation required in the production of bright finishes. Operator above is using a surface analyzer.

other halogen acid baths also produced a variety of binary and ternary precious metal alloys.

A commercial process for depositing an 80-20 cobalt-nickel alloy was disclosed[93] as being used on wire for wire recording applications and special calculating devices. Periodic reverse current equipment is a basic part of the process.

A number of patents on alloy plating were granted during the year. A process for depositing iron-indium from an acid bath was patented[94] in England, for preparing bearing surfaces on steel backing. Two patents[95, 96] were granted for fluoborate baths for depositing lead-tin-antimony alloys. Another was granted to *Smith*[97] for acid baths for rhodium-nickel and rhodium-cobalt alloys.

Purification

The general problem of plating bath purification and the effect of impurities, especially on bright nickel solutions, is still under study by one of the research projects of the AES. An extensive abstract of previously published work on the effects of a large number of impurities in nickel baths was made[98], and a standard procedure for study of commercial and proprietary bright nickel solutions was developed[99]. The specific effects of impurities will be evaluated by means of tests for appearance, adhesion, salt-spray, ductility, hardness, throwing power and bath efficiency. *Colgate*[100] discussed in general terms the various methods available for plating bath purification, and in detail the purification of nickel solutions by electrolysis at both high and low current densities, by chemical precipitation and oxidation, and by absorption. *Wommelsdorf*[101] reported a method for removing nitrates from nickel and alkaline plating solutions.

The practical plater, who is not interested so much in what impurity is in the bath and what its specific effect may be as he is in keeping it from spoiling his bright nickel plated work, has depended more heavily during the past year on continuous filtration and carbon purification, which operations have become standard practice throughout the industry.

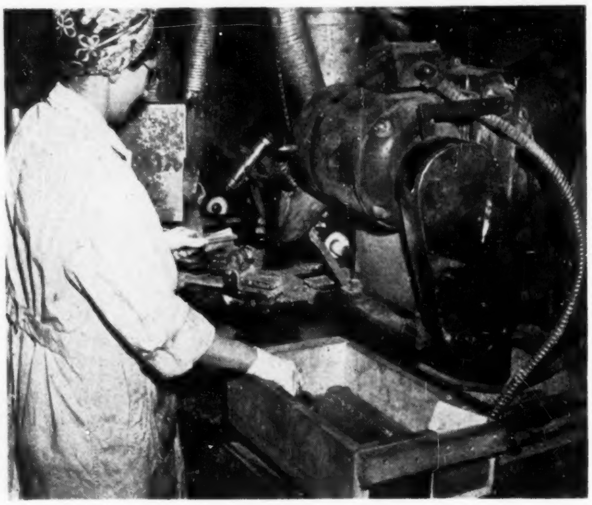

Figure 6—Shown above is an automatic polishing machine using liquid abrasive compositions sprayed on the wheel from a gun. Economy in materials and production is greatly improved in this way.

Special Surface Treatments

Phosphate Coatings

An excellent description of the economics of using phosphate coatings for lubricating purposes in deep drawing and wire drawing was given by *Holden* and *Scouse*[102]. *Wustefeld*[103] also investigated the same application of phosphating, and found that a light phosphate coating was as effective as a heavy coating when using alkaline soaps for lubrication.

The increased use of phosphate treatments for paint bonding resulted in a number of large-scale, fully automatic finishing systems being installed in industrial plants. Most of these utilize the spraying method for producing the coating. A patent was granted to *Gilbert*[104] for a phosphating bath containing boron phosphate in addition to the phosphoric acid and metal phosphate, and another was granted to *Tuttle* and *Navoy*[105] for a sealing treatment for phosphate coatings which was claimed to increase greatly the corrosion resistance of the coating, and also which could be colored with dyes.

Anodizing Aluminum

Several important fundamental studies of the anodizing mechanism were made during the past year. *Kronsbein*[106], studying the efficiency of the anodizing process, disputes the theory that anodic coatings "grow inward", and concludes that it is the rate of re-solution of the oxide coating which accounts for the apparent low overall "oxygen efficiency". *Bradshaw* and *Clarke*[107] also studied the efficiency of the sulfuric and chromic acid processes on various alloys and determined the weights of coatings produced under various conditions. They did not agree, however, that there was any clear evidence of re-solution of the oxide concurrent with the formation of new oxide. They also measured the stresses induced by the sealing treatments.

Herenguel[108] developed several special alloys and techniques which would give completely transparent oxide films. A pretreatment step to insure clear anodic films on aluminum alloys, involving solution of harmful alloying elements from the surface of the parts in a hydrofluoric-nitric acid bath, was the subject of a patent granted to *Humber Ltd.*[109] Other British patents[110] were granted for methods for sealing anodized coatings so as not to spoil its high reflectivity through the formation of the usual powdery coating.

A method for chemically anodizing aluminum alloys in solutions containing carbonates, chromates, and albuminous materials was patented by *Shawcross*[111]. A similar non-electrolytic anodizing process, in which the articles are placed between, but not connected to, insoluble anodes and cathodes was also the subject of a recent patent[112]. The process is particularly applicable to anodizing screw heads, large hollow vessels, or thin foils which cannot conduct the high currents required in conventional processes. Single sides of sheets could also be anodized by this method.

A discussion of the problems involved in continuous anodizing of aluminum wire and strip was given by *Pullen*[113].

Anodizing Magnesium

New activity in this field was confined to the granting of several patents. One[114] claimed that a heavy coating could be obtained with good adhesion and low porosity. Another[115] granted to *De Long*, involved soaking the parts in the bath for several minutes before and after the regular anodic treatment. The bath was composed of alkali hydroxide and a water-soluble aliphatic hydroxyl, such as methanol, ethanol, glycerol, etc. *Coates*[116] also received a patent for an acid anodizing bath consisting of dichromate, sulfates, acetic acid, and sodium acetate.

Miscellaneous Surface Treatments

A method for producing an oxide film on platinum metal by means of anodic treatment was developed by *Altmann* and *Busch*[117]. This might have some application in the jewelry field as a "coloring" treatment.

A low temperature aqueous bath for blackening stainless steels was patented by *Clini*[118], and another for blackening copper alloys was patented by *Newell*[119].

Whitby[120] developed a new method for protecting magnesium alloys which involved immersion or anodic treatment in solutions of selenious acid and sodium dichromate. The treatment was claimed to provide a good paint base and increased resistance to salt spray attack.

The formation of separating films, a problem of great importance in the electroforming and electrolyzing industry, was the subject of a discussion by *Mehl*[121].

A new method for chromizing steel in a molten salt bath was proposed by *Campbell* and his co-workers at Battelle[122]. The bath operates at 900-1200° C. with case formation rates equal to or better than in the various pack chromizing methods. Because of the much shortened heating and cooling time in salt baths, this should be a much more practical method.

Galvanizing

Several large installations were made at the steel mills for continuous hot dip galvanizing of strip during the past year at speeds up to 300 ft. per minute[123, 124]. One of the problems of the galvanizing process, that of developing a substitute for the expensive and strategic palm oil, seemed a little nearer to solution, according to a report by *Bastian*[125]. Large scale production tests indicate that one oil now being considered as a palm oil replacement gives equally good results at a saving in cost, and would be readily available domestically. *Crow*[126] outlined a method for practical and economical control of the pickling baths used in hot dip galvanizing, and *Imhoff*[127] discussed the role of lead content of the bath on the bending properties of the coating.

Testing and Analysis

With the increased use of sensitive bright plating baths and the wider use of specifications for deposit properties, there was a decided emphasis on the development of more accurate, rapid, and informative tests for both the solutions and the deposits.

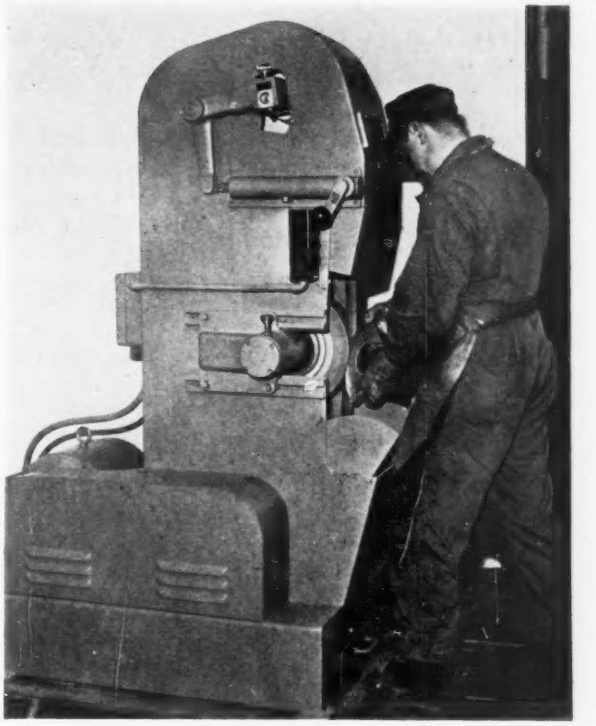

Figure 7—Contour polishing, using flexible back-up wheels and fast-cutting abrasive belts is providing another economical method of surface finishing.

Solution Analysis

Nickel baths received the widest attention, with *Foulke*[128] outlining colorimetric methods for rapidly analyzing the baths for principal constituents and impurities. *Gardner*[129] described a polarographic method for determining small amounts of zinc and cadmium in nickel baths, while *Serfass*[130] and his co-workers reported on colorimetric methods for traces of zinc, using dithizone as a reagent; for ammonium ion[131], using Nessler's reagent; for chromium[132], using diphenylcarbazide; and for calcium[133], using a precipitation and colorimetric technique. *Carter*[134] also reported a rapid potentiometric method for cobalt.

Silverman[135] gave a detailed discussion of the analysis of cadmium baths, using an iodate-thiosulfate titration method for cadmium that requires no external indicator. *Osborn*[136] gave details of an electrolytic method for cadmium in the presence of zinc, copper, and nickel, with no interference. *Barker*[137] and his associates also discussed the determination of cadmium in the presence of large excesses of zinc.

A rapid gravimetric method for gold in cyanide baths was given by *Rochat*[138].

Why anyone would want to patent a method of analysis is a little hard to understand, nevertheless a patent[139] was granted for a method of analyzing tin fluoride plating baths.

Deposit Testing

A new shop type thickness tester, based on an electromagnetic principle, was placed on the market[140]. This tester was applicable to non-magnetic coatings on magnetic base metals. *Bendix*[141] obtained a patent on

an electrolytic stripping tester for tin plating thicknesses. The development of a standard dropping test for lead plating thickness was discussed by *Hammond*[142].

The subject of porosity of electroplated coatings was the subject of two reports[143] by the AES research committee that is studying the basic aspects of the subject. It was found that the crystal structure has a decided effect on the intrinsic porosity. *Glazunov*[144] discussed "masked pores", with methods for their detection by means of an electrographic technique.

For an instrument for measuring surface reflectivity (brightness), a patent[145] was granted to *Liben.*

Waste Disposal

The problem of plating waste treatment and disposal is one of the most pressing and important in the entire industry. The time is rapidly approaching when every plating establishment will have to take positive steps to insure a sufficiently low toxicity of its wastes. Public Law 845 was enacted by Congress in June of last year, making it possible for states to obtain additional Federal financial aid to help overcome its internal problems involving stream and sewage pollution. This is expected to hasten the day of reckoning for plating plants.

The plating industry has itself attacked the problem in various ways. A research committee of the AES continues to study the problem, and recently made a comprehensive survey of the problem and possible methods for its solution[146]. *Pettel*[147] also discussed the overall problem, and gave figures on cyanide destruction and chromium precipitation by the chlorination and ferrous sulfate-lime treatment methods. He mentions keeping the various types of wastes separated for most conomical treatment. In connection with economical waste treatment, several articles by *Kushner*[148] pointed out how the problem could be attacked through economical use and re-circulation of rinse waters to keep down the volume of waste requiring treatment.

Priester[149] discussed a large plant installation for plating waste treatment which used the calcium hypochlorite, acidifying method for cyanide destruction, bringing the cyanide from 85 ppm down to essentially O ppm. *Kominek*[150] and *Bleiweis*[151] also discussed large scale treatments, giving some cost figures and operating data of practical value.

Oyler[152] and *Sperry* and *Caldwell*[153] described methods for cyanide destruction that could be used by the plater himself in a spare tank, involving hot electrolysis with insoluble anodes and very high current densities.

A development[154] which promises to be important to the small shop is a method of treatment by simple addition of a reacting chemical that destroys soluble cyanides in a period of minutes in a cold solution. After filtration, the waste water can be dispensed to the sewer. Reduction of cyanides down to 1 ppm are obtainable if necessary.

A patent[155] was granted for a method of destroying cyanides, converting them to ammonia and carbon dioxide by oxidation.

Purification of chrome-bearing wastes also was the subject of some investigation, with *Kelch* and *Graham*[156] discussing an electronic control system for the safe discharge of chromic acid wastes automatically.

Commercial Developments

Processes

A number of commercial processes and products of importance were introduced during the past year. Space does not allow for a complete resumé of them all, but the paragraphs below will serve to point out the high-light items.

Outstanding in the plating field was the development of a high-speed, self-regulating chrome plating bath[157] that is claimed to have 50% greater cathode efficiency, better throwing power, and wider bright plating range than the conventional baths now in widespread use. Another important feature claimed for the process is that the catalyst is self regulating, requiring no addition of catalyst to maintain a "ratio". The process is available with no licensing agreement required.

A bright copper bath of the cyanide type was introduced which was claimed to have a very wide bright range[158], and a new acid copper, bright plating solution was also developed[159] having all the desirable characteristics of conventional acid copper baths, plus the ability to produce fine-grained, smooth, bright deposits. A high-speed brass solution was also placed on the market[160].

A process for depositing metals from the gaseous state was said to be nearly ready for commercial use[161]. Some advantages of such a process would be an extremely high "plating" rate, absence of throwing power considerations, and ability to "plate" such metals as tungsten, molybdenum, chromium, nickel, and others on a wide variety of metallic and nonmetalic materials.

Several new chemical polishing methods were announced for brass and aluminum[162, 163, 164, 165, 166]. Such processes are valuable for producing a final lustre in place of a color buffing operation on certain metals or alloys.

An alkaline chemical stripper[167] for nickel, copper, zinc, silver, and gold plated steel was also placed on the market which was claimed to prevent etching and attack on the steel base. This could result in considerable saving in the reprocessing of defective work.

Equipment

Most of the new developments in equipment over the past year involved re-design for simpler or more efficient operations. Several items which were a little unusual, however, were a multibarrel tumbling machine of unique design[168], a unitized tank coil heater design[169], a solid nickel tube heat exchanger for bright nickel baths[170], and a high speed agitator for use in increasing the maximum current density permissable in automatic bright nickel plating machines[171].

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(*Continued on page* 108)

Electrolytic Polishing of Metallic Surfaces—Part VI

By Dr. Pierre A. Jacquet, *Ingénieur-Chimiste I.C.P., Docteur de l'Université de Paris, France.*

Diffusion at the Interface of the Metals

IN ORDER to study the diffusion of the atoms of one metal into another metal, one of the methods used is to place two cylinders in close contact, one of the pure metal and the other of an alloy of the same metal with the metal to be studied. The unit is treated at the temperature and for the time desired, and then sectioned in such a way as to be able to determine the concentration of the element by the thickness of growth, starting with the interface of the initially pure metal.

The state of the surface of the two cylinders is obviously of prime importance. According to the results of the experiments of *Buckle*[61] electrolytic polishing is the best method to obtain a very smooth surface and also one free from physical disturbance or chemical contamination, especially in metals of lower hardness.

Hardness and Micro-hardness of the Surfaces

Measuring the hardness is a method often used to control the quality of metallic materials, and follows the mechanical and thermal treatments in the course of fabrication of these materials. In general, no great importance is placed on the nature of the surface of the sample; it suffices that it be sufficiently "smooth" so the impression may be measured with good accuracy. Certainly the influence of the state of the surface becomes more important as the force applied to the metal diminishes, for the impression, being shallower, involves the superficial layers then. One would thus think that under very feeble forces, the values of the hardness determined on the same material having received either mechanical or electrolytic polishing might be different. These differences have, in effect, been obesrved even with relatively large weights. Thus according to *A. Faust*[62] the hardness of annealed copper polished with number 0 emery paper is all the higher as the force is reduced (below 4 kg/mm^2). On the contrary, on an electrolytic polish the values for hardness are practically independent of the force. Copper strongly cold worked into sheeting does not give rise to such differences between the two types of surface states, for abrasion with emery paper does not create supplementary cold working.

The measure of the hardness under very low forces (about twenty or thirty grams or less) involves a new method of investigation in metallography.[63] The impressions obtained under these conditions, having very small dimensions, should be observed microscopically under high magnification, therefore it is necessary that the surface be very well polished. Furthermore, this method measures only the surface hardness of the material, and in order for this value to correspond to the true structure it is necessary that the surface be free from all physico-chemical disturbance. For example, the micro-hardness value on a surface such as that represented fully in Figure 16 will be abnormal, for it will correspond to the layer deformed by polishing with emery paper. A correct value will be obtained on an undistorted surface such as is shown in Figure 20. Mechanical polishing will introduce a more or less great error into the determination of micro-hardness, depending on the sensitivity of the metal to cold working. For many metals mechanical polishing should be replaced by electrolytic polishing. For illustration, the micro-hardness of mechanically polished aluminum is 30 to 40% higher than that electrolytically polished.[64] By successive solution of the superficial layers of copper formed by abrasion with emery paper, through successive anodic polishing, *Leise*[65] has shown that a constant micro-hardness is only obtained after elimination of a layer 0.08 mm thick (Figure 43). The micro-hardness is so sensitive to the physical structure of

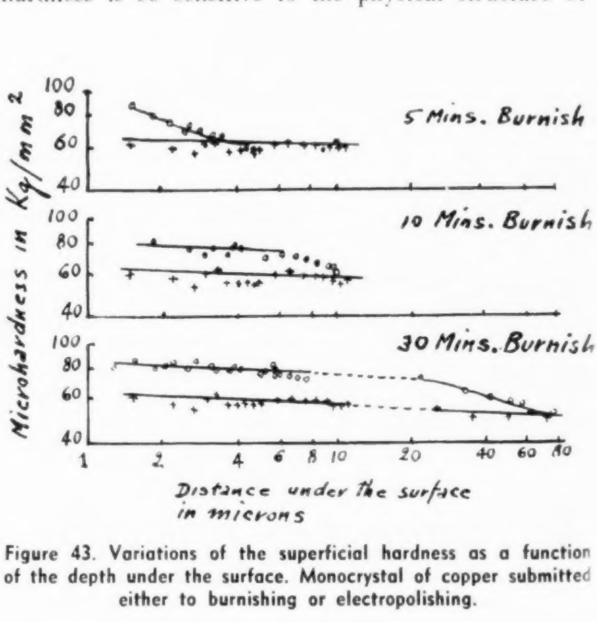

Figure 43. Variations of the superficial hardness as a function of the depth under the surface. Monocrystal of copper submitted either to burnishing or electropolishing.

TABLE IV
Properties of Steel Studied in the Frictiograph

Designation	*Composition*	*Treatment*	*Structure*	*Hardness*
RAD	Rolled steel		Carbides in fine Martensite	Rockwell C-63
AD3M	Ni-Cr-Mo case hardening steel	Case hardened and quenched	Martensite and a light network of Cemenite	Rockwell C61-63
FDM-1	Semi-hard Ni-Cr-Mo steel	Quenched and tempered to about 155-160,000 psi	Homogeneous Sorbite	
FDM-2	Ditto	Quenched and tempered to about 225-240,000 psi	Fine Martensite	
GK5	Nitrided Cr-Mo steel	Nitrided	Nitrides in the network	Vickers 900

the surface that it constitutes one of the better techniques to show the disturbed layer due to mechanical polishing.

On the condition that electrolytically polished samples are used, a measure of the micro-hardness, under very light forces of the order of a few tens of grams, allows the detection of very small amounts of impurities in solution in a metal.[66]

The Phenomena of Friction and Wear

The factors which govern the processes of friction and wear of mechanical parts are extremely numerous and of a complex nature. Some depend upon the metallic material itself, and among them the characteristics of the state of the surface should be taken into consideration. Up to the present little research has been done on the possible advantages of electrolytic polishing, either for the study of the processes of friction and wear or for its practical applications.

Since anodic polishing removes the ridges from a surface and thus modifies the microprofile, one would think that the coefficient of friction would be diminished with respect to that of the same material which has been finished by means of mechanical methods. However, the microprofile is only one of the characteristics of the state of the surface and it is not certain that the others do not play as fundamental a role from the standpoint of friction and wear. Finally, the pieces under friction are always subject to lubrication, but we ignore the specific behavior of the film of oil as a function of the surface state.

For all of these reasons it is difficult to predict in advance whether electrolytic polishing is able to reduce friction and increase the resistance to wear. In any case, the fact that the characteristics of this new surface state are easily reproducible and actually correspond to the properties of the mass of the material, allow us to envisage a systematic study of the influence of these properties, which is impossible with surfaces prepared by machining or mechanical finishing.

The most complete work undertaken up to the present on friction and wear of electrolytically polished surfaces has been published by *R. Mondon*, director of the Hispano-Suiza research laboratories.[67] The experiments use the reciprocating frictiograph of *Marcelin*. In this apparatus the friction piece is composed of a wheel of tin bronze (mechanically polished with number 0000 emery paper), fixed on its axis and loaded with a known weight, which is moved with a reciprocating rectilinear motion (one alternation per second through 60 mm) on the block of metal under study. This block, in the form of a parallelopiped, is mounted on a friction roller and is found to be carried along by the friction of the wheel, but it is held back by a torsion bar which limits the amplitude of the oscillation to a few millimeters. It is this amplitude, automatically registered as a function of time, which serves as a measure of friction. The wear is determined after a certain time of operation, by measuring the surface of the worn face of the wheel, or even by examining the scratches formed on the block of metal being studied. The friction is always obtained in the presence of lubrication of the type known as "stratofilms," or those which correspond to the minimum thickness of a film of oil.

R. Mondon has compared five types of steel used commercially in aircraft motors, and exhibiting two states of surface: one very finely finished mechanically and an electrolytic polish according to the method called Hispano-Suiza "electrochemical superfinishing." Table IV gives the characteristics of these steels. Table V is a summary of the experimental results.

Each value in this table is the average of six runs made under the same conditions but each time with a new block. The favorable influence of electrolytic finishing on friction and wear is immediately apparent. The coefficient of friction is two to six times less than that of the surface of the same steel mechanically finished. This result should be attributed to the modification of the coefficient of bearing surface as a result of the solution of the micro ridges. It is important to notice also that in the case of electrolytic finishing, the coefficient of friction has nearly the same value at the start of the test and after three minutes. On the contrary, this coefficient diminishes with time for those surfaces which were mechanically finished. This reduction corresponds to the phenomenon of grinding which consists of the reduction of the microprofile by wear of the most prominent ridges.

The experiments which are to be described are still

TABLE V

Influence of Surface Finishing Method on Friction and Wear*

	RAD		AD3M		FDM-1		FDM-2		GK5	
	MP	EP	MP	EP	MP	EP	MP	EP	MP	EP
Initial friction	7.	1.62	5.66	1.50	5.62	1.75	6.33	2.37	4.41	3.08
Friction after 3 minutes	3.7	1.79	2.04	1.79	2.17	2.04	3.66	2.33	4.50	3.41
Wear of the friction piece after 3 mins.	7.28	3.80	4.65	1.07	3.87	1.66	5.28	1.63	2.95	2.01

MP Mechanically polished surface.
EP Surface polished electrolytically after smoothing down.
* Measured in the reciprocal frictiograph with a friction piece of tin bronze. See text for description of machine.

insufficient to be able to contribute much to our knowledge of the mechanism of friction and wear, because they deal with, for example, the structure and the hardness of the material. Nevertheless they are still of considerable interest in electrolytic polishing, and justify the tests which have actually been started in France.

We will also point out the use of electrolytic polishing made by *Sakmann* and his co-workers[68] in their study of friction and wear by means of the ultra-sensitive technique of radioactive indicators. The method consists of sliding a previously irradiated copper-glucinium alloy friction piece upon a surface. The transfer of matter from the friction piece to the surface is measured by the radioactivity acquired by the latter. In order to suppress the causes of error it is very important that the surface of the friction piece does not retain any non-adherent metallic particles, which goal is attained by the use of electrolytic polishing.

Research on the phenomena of friction, dry or in the presence of lubricants, conducted at the laboratory of Tribophysics in the University of Melbourne under the direction of professor *W. Boas*, uses electrolytic polishing of metallic surfaces in order to avoid cold deformations caused by mechanical finishing[69]. We also would point out the work of *Gwathmey*.[96]

Influence of the State of the Surface on the Mechanical Properties of Metals and the Phenomenon of Fatigue

The mechanical properties concern all of the mass of a metal and are well defined properties which depend largely upon the metallographic structure. However, the state of the surface plays a certain role. It is known that a mark or fissure on the external surface of a metallic piece favors its failure under external pressure. This influence is considerable under dynamic tests of alternating forces (fatigue), and it is not negligible in static tensile tests of fragile materials, in which the failure occurs a little sooner without previous plastic deformation. In this latter case mechanical polishing raises the resistance to tension. The effect may be due to either the modification of the microgeometric state of the surface, or to the layer of cold worked surface resulting from polishing and which is harder than the adjacent metal. In order to decide between these two explanations it is sufficient to substitute mechanical polishing for electrolytic polishing, which in itself modifies the microprofile without deforming the superficial layer. The experiment conducted by *Crussard* has shown that it is the elimination of the micro peaks which causes the elevation of the rupture limit[70]. Thus, the breaking strength of a tempered steel is 38-54 kg/mm² in the crude state, but rises to 68 kg/mm² after electrolytic polishing. Crussard further observed that this finishing reduced the divergence of the experimental values by causing those cases where the strength is abnormally low to disappear.

The effect of anodic polishing on the fatigue of metals is very complex, for this property depends upon numerous factors. It is not possible in the actual state of our knowledge to predict, a priori, whether electrolytic polishing will modify the resistance to fatigue of a specific metallic material. Only experience will be able to answer this question.

It is known that the limit of endurance to fatigue is all the higher as the surface of the tested sample is smoother. Any scratch or defect on the surface is, in effect, the most likely place for the concentration of the stress and the failure starts at such a defect. It is thus reasonable to think that anodic polishing, which eliminates the scratches and ridges, will elevate the limit of endurance. Actually this is only valid in the case of a material with a perfectly homogeneous struc-

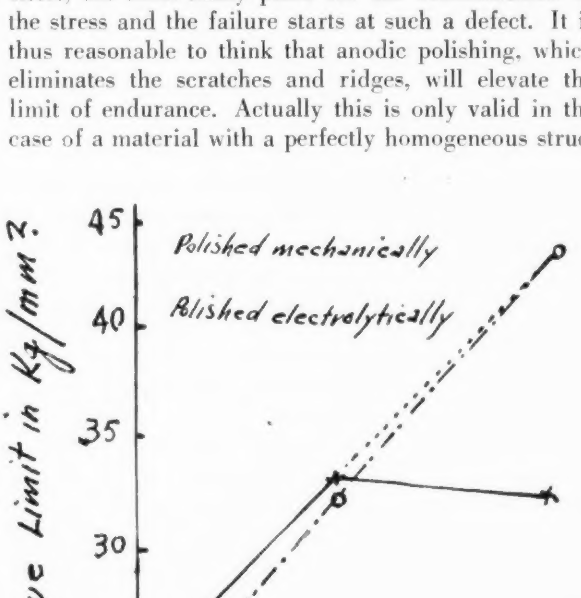

Figure 44. Influence of electrolytic superfinishing on the fatigue limit by alternating torsion of an FDM steel, as a function of the tensile strength. (from *R. Mondon*)

ture, for we know that physical and chemical heterogeneities are revealed by anodic solution, thus causing the appearance of a new irregularity which will be able to favor a premature rupture. Among the defects shown during anodic polishing, the non-metallic inclusions are the greatest nuisance, for they are torn from the surface and leave pitting which may later constitute the start of a failure.

The state of the surface is not the only factor which affects the resistance of a metal to fatigue. The nature and the structure of the superficial layer also plays an equally important role.[71] In certain steels, mechanical finishing causes the appearance of zones in the vicinity of the surface which are the site of mechanical compression stresses.[72] These stresses may favor good behavior of the material in fatigue, and thus their formation may be desirable. It is for this reason that shot peening is currently used for finishing springs.

Knowing that the superficial layer is dissolved by electrolytic polishing, it removes the mechanical stresses localized there at the same time. This has been verified by experience[73]. A sample of finely polished (by grinding) steel shows compression stresses of the order of 50,000 psi., but after electrolytic solution of approximately 25 microns of the metal the stresses become non-existent. It is possible that the limit of endurance to fatigue may be reduced by elimination of the favorable stresses and in spite of the modification of the microprofile. Current experiments have as their aim the determination of whether the predominant effect is the removal of the stresses, or altering the microgeometry of the surface.

We now see that the effect of electrolytic polishing might be quite variable as a function of the following principal variables: nature of the material, presence of heterogeneities in combination with the methods of finishing and mechanical or thermal treatment, micrographic structure. This complexity makes impossible all generalization of the experimental results which have proven the favorable influence of anodic polishing on the resistance of certain steels to fatigue. That is the conclusion at which *R. Mondon* arrived in a study carried out in the Hispano-Suiza laboratories, and of which we are going to summarize the principal results[74]. The tests were made on a large model Schenck machine by alternating torsion:

Special Chrome-Molybdenum-Nickel Steels

These are very high quality steels used in the manufacture of aviation motor connecting rods and crankshafts. After receiving the thermal treatment, the limit of failure varies from 115-240,000 psi. Mondon has determined on several series of samples very finely finished (mechanically), either followed or not by electrolytic super-finishing, the limit of fatigue as a function of the tensile strength. The results shown graphically in Figure 33 prove that in the tempered state (martensitic structure, tensile strength 240,000 psi.) electrolytic polishing raises the limit of fatigue by 34%. For annealed or tempered samples (sorbitic structure) electrolytic polishing causes a slight lowering of the limit of endurance, probably as a result of elimination of the superficial cold working. The most important point is that, contrary to mechanical finishing, anodic polishing regularly increases the limits of fatigue according to the increase of the mechanical properties of the steel; all of the points are on a straight line, or in other words a drop in endurance is not observed when the tensile strength goes from 155,000 to 225-240,000 psi. This very interesting advantage is certainly due to the disappearance of the micro scratches, to which the high mechanical property steels are known to be very sensitive.

Nickel-Chrome-Molybdenum Case-hardened Steels

Here again electrolytic polishing causes a noticeable increase in the limit of endurance to fatigue. This treatment also reduces the wide spread of results and consequently facilitates tracing the curve of Wohler.

Chrome-Molybdenum Steel

With these steels anodic polishing causes an appreciable lowering of fatigue resistance in comparison with mechanical finishing, and does not improve the scattering of results.

In order to explain these apparently contradictory results it should be noted that the steels for which anodic polishing is favorable contain very few non-metallic inclusions and the fatigue cracks never start at these rare inclusions. On the other hand, chrome-molybdenum steel and ordinary carbon steels exhibit numerous lines of inclusions which serve to instigate the failure. Accepting, as previously stated, that the electrolytic finishing exposes these inclusions and often even exaggerates their size, the treatment should favor fissuring and therefore lower the limit of endurance.

Besides the inclusions, the defects of machining should be taken into account. Poor rough finishing leaves marks which seem to be removed by the later fine finishing, but in reality they are only masked and re-appear in the course of electrolytic finishing. Certainly these marks lead to a defective microprofile which again favors rupture by fatigue.

All of these results have been obtained with standard fatigue samples. It seems very instructive to extend them to the case of assemblies or to parts used in mechanical construction, which have a more or less complex structure and exhibit holes, fillets, threads, etc. Some tests, still too few in number, seem to prove that for such pieces, electrolytic finishing nearly always improves the resistance to fatigue regardless of the quality of the steel used.

Besides its eventual practical interest for the finishing of mechanical parts subject to fatigue, electrolytic polishing contributes a very valuable method for the scientific study of the processes of rupture under alternating stresses. An article of *Jacquesson & Laurent*[75] is concerned with the micrographic study of the fatigue fissures on the surface of aluminum samples which have been polished electrolytically and submitted to alternating torsion tests. Quite different

(At Left)
Direction of axis of torsion.
Figure 45a. Fatigue tests on aluminum polished electrolytically in aceto-perchloric bath. Cold hardened by rolling. Appearance of the surface after 600,000 cycles. Max. shear stress 3.6 Kg/mm².

(At Right)
Direction of the shearing stresses.
Figure 45b. Cold hardened by rolling, then annealed 30 mins. @ 400°C. Appearance of surface after 540,000 cycles. Failure occurred at 675,000 cycles. Max. shear stress 3.6 Kg/mm².

states were studied, such as metal cold-hardened by rolling or recrystallized by annealing. In the former case the lines of discontinuity are parallel to the forces applied and appear to be unrelated to the crystallographic structure (Figure 45a). With annealed aluminum the rapid appearance of slip bands is noticed and the contour of the crystals stands out more and more clearly as the fatigue is increased (Figure 34b). These differences in appearance are so sensitive that they may serve to define the threshhold of recrystallization.

In conclusion electrolytic polishing allows a systematic study of the phenomenon of fatigue by separating the fundamental factors, which are the microgeometry of the surface, the strucure, and the superficial stresses inherent in the metallic material. The perfection of the polished state greatly facilitates the detection of heterogeneities, fissures and traces of plastic deformation of the samples.

Conclusions

The majority, if not all of the properties of metallic surfaces polished electrolytically differ from those of the same metal polished according to the purely mechanical techniques (using friction with abrasives). A comparative study of the properties of the surfaces obtained by these two methods shows without ambiguity that only electrolytic finishing conserves the intrinsic characteristics of the metal, and that is limited by the external medium. All of the effects which have been reviewed constitute, in fact, the immediate field of application of anodic polishing, applications which, although on a laboratory scale at present, indicate interesting practical possibilities. From all of the evidence, and some proof has been supplied, electrolytic polishing provides a new tool which should aid the physico-chemist and the metallographer to further explore into the knowledge of the metallic state.

We must now give more detailed information of the practical applications of electrolytic polishing already known, and visualize those which should develop in the future.

Industrial Applications of Electrolytic Polishing

First discovered in the course of an investigation directed at the resolution of a purely industrial problem, then becoming a laboratory curiosity before attracting the attention of physicists and metallurgists as a valuable working tool, electrolytic polishing is now assuming a more and more important place in industry. It serves in the finishing of many metallic parts, and even tends to be used at certain stages of manufacture of intermediate products, and in the manufacture of articles starting with these intermediates.

Electrolytic Polishing Applied to Decorative Finishing

The actual development of anodic polishing as a method of finishing is explained by the advantages which it presents in comparison with mechanical polishing. These advantages are both technical and economic.

Economic Advantages

These result principally from the reduction of the expensive manual operations needed by the mechanical procedures. The same thing is noticed here, but on a much vaster scale, as is found in the metallographic laboratories when the rapid electrolytic method is substituted for abrasive polishing. Quite often electropolishing is not only a simple finishing operation but also becomes a manufacturing process. Such is the case, for example, with electro-finishing.

In many finishing shops an object is first polished in a special room, then taken to the plating room where it is degreased, cleaned, pickled and introduced into a nickel or copper plating bath. After each of these deposits the piece is returned to the polisher, then receives a new degreasing, etc., before the final deposit of chromium which itself may need polishing later. Anodic oxidation of aluminum and its alloys is also preceded by mechanical polishing. The sequence of these operations thus requires personnel occupied at polishing, transporting, racking and unracking the pieces. In its most highly developed form, electrolytic polishing should allow this work to be done continuously, since the polishing of the base, the brightening of the intermediate deposits, and the final plating may be performed without the object being removed from its rack and transported to a special room. Such continuous operations are already in industrial operation in a few special cases (nickel plating of small

brass objects, anodic oxidation of aluminum) but some difficulties not yet perfectly overcome generally limit electrolytic polishing, either in the preparation of the base or in the finishing of the final deposit. It is for this reason that table ware of german silver is polished mechanically then receives a deposit of silver which is electrolytically polished[76]. It is the same with automobile accessories of steel (bumpers) in which the polishing is done mechanically, then the final nickel deposit is electrolytically polished. On the contrary, brass pieces are electrolytically polished and then covered with a thin deposit which is brightened mechanically. In order for the electrolytic process to be completely integrated into a manufacturing continuity, and thus reduce the cost of manual operation, it is necessary to coordinate several conditions: a) the base metal should be homogeneous and free of noticeable surface defects, b) the thickness of the electrolytic deposit should be sufficient so that the amount upon removal from the polishing bath will still afford good protection. Actually, the first condition is the most difficult to obtain. Steels contain inclusions and heterogeneities which are removed by mechanical polishing, but in contrast are revealed or even exaggerated in anodic polishing baths. The light alloys present difficulties of the same type which we are forced to reduce to a minimum by emphasizing upon special qualities for electrolytic polishing[77]. It is evident that the metallurgy industry should make substantial efforts to supply the users with intermediate products (sheets, bars) of high purity. Nevertheless, alloys which are of a heterogeneous nature (tool steels, silicon-rich light alloys, two-constituent brasses, bronzes, etc.) will always be impossible to polish electrolytically.

In spite of the numerous restrictions which will probably be lessened later, the economic advantages of electrolytic polishing justify its adoption in finishing plants for manufactured articles. Several publications contain interesting comparisons between the respective cost of the two processes[78].

Technical Advantages

These advantages are varied: Certain materials which are very difficult to polish mechanically are easily electropolished. Here, the technical advantage is augmented by the economic advantage, because a difficult polishing job is necessarily costly. A typical case is that of stainless steel, and this explains why the first industrial application of the anodic process was directed specifically at this class of alloys, in addition to more and more use for the fabrication of a large variety of articles. It also happens that the metallurgical industry supplies excellent qualities of stainless steel. In addition these steels are polished successfully in several types of inexpensive electrolytes.

Several United States factories have been using large electrolytic polishing installations for stainless steel pieces[79] for several years, and different processes are in competition (Battelle Memorial Institute, American Rolling Mill, DuPont de Nemours, etc.).

Pieces of complex structure can be uniformly polished. Traditional polishing is difficult when the article contains deep hollows. On the other hand the anodic method is convenient for all shapes and the throwing power is generally sufficiently good so that formed cathodes are rarely indispensable. It is even possible to polish the interior of the walls of tubes of only a few millimeters diameter. Polishing of very small pieces is equally possible[80].

Special Applications of Electrotytic Polishing

All of the properties conferred to metallic surfaces by electrolytic polishing embody a large number of advantages which are potentially applicable industrially. Among these applications the most spectacular is electrolytic superfinishing. Because of its industrial importance it will be described later in a special chapter. Of the particular advantages of the electrolytically polished state may be mentioned the increased ability to reflect, the absence of a disturbed layer of metal, the elimination of very fine ridges, and easy passivation (which includes a certain resistance to corrosion). We will rapidly review a few of the applications which arise from these specific properties.

1. Elimination of the striations and increasing the reflecting power leads to the preparation of reflecting surfaces (reflectors and mirrors) provided that the material is very homogeneous. Excellent mirrors have been successfully prepared by the electrolytic polishing of aluminum.

2. The absence of a disturbed layer, striations and superficial impurities has many advantages for aluminum or its alloys destined for anodic oxidation and coloring. It is known that the layers of aluminum oxide obtained on an electrolytic polished surface is less porous and therefore more protective than on a mechanically polished one. The increased reflectance, superior to that of mechanical polishing[81] is well preserved and the tinting produces a striking decorative effect. This application has been developed in France.

3. Since anodic polishing of a surface favors the phenomenon of crystalline continuity it should equally improve the adhesion of electrolytic deposits. Even when the base metal and that of the deposit are too dissimilar to allow actual crystalline continuity to occur, the structure of the base metal still plays an important role from the point of view of distribution and growth of the "seeds" of the deposit. However, this role, as we have already seen, is only possible on the condition that the superficial structure of the support is neither disturbed physically or chemically contaminated.

It is also known that the cold worked layer often exhibits a lower resistance to rupture than that of the normal material or of a deposited layer of the metal. On the other hand the fissures present on the surface are able to retain foreign materials (oils, greases, acids and alkalis) which start local corrosion and cause separation of the plating. By suppressing these frequent defects of mechanical polishing, electrolytic polishing improves adhesion. Experiments have shown remarkable adhesion of nickel deposited on steel treated thus, and it is probably the same for electrolytic chromium deposits. Cathodic silvering of

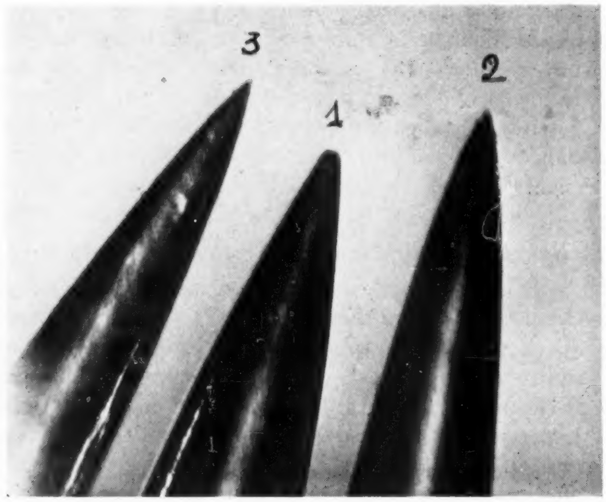

Figure 46. Phonograph needles. Center—normal state; Right—electropolished for 3 mins.; Left—electropolished for 10 mins. (from "Atomes"). x40.

bearings on surfaces polished electrolytically has reached the industrial stage[82].

For these electroplating applications it must be remembered that the metals polished electrolytically may acquire, either during the polishing process or in the course of washing or even at the first instant of contact with the atmosphere, an appreciable passivation. The film responsible for this passivation detracts from the good adhesion of the plating and should thus be eliminated by a special treatment called depassivation or activation. For this purpose alkaline or acid solutions are used, in which the polished pieces are immersed for a very short time. Anodic or cathodic polarization often facilitates this activation.

For the preparation of surfaces destined to be covered with cathode deposits, electrolytic polishing, in contrast with chemical pickling, allows regular solution of a controlled thickness of metal. In this way the quantity of metal removed may be exactly replaced by the same thickness of plating. This factor is particularly important in the mechanical uses of hard nickel and chromium, for they require a final machining. In England electrolytic polishing is applied in the preparation of aircraft parts which are to be chrome plated later. By operating under definite conditions, always identical, the amount of steel dissolved in the course of polishing is replaced by the equivalent amount of chromium, without modification of the piece[83]. The Russian technicians as well have recommended electrolytic polishing of tools before hard chrome plating [84] and in France machine parts electrolytically superfinished later receive an electrodeposit.

4. The elimination, by means of electrolytic polishing, of the smallest ridges and surface impurities is profitably used in the manufacture of small pieces of electronic apparatus, for in this way undesirable phenomena are avoided (cold emission of electrons for example) during the operation of the apparatus. The anticathodes of X-ray tubes and the lenses of electron microscopes are polished electrolytically[59,60]. This process also allows the preparation of extremely fine metallic points which may be equally of interest in electronics or other applications. Figure 46 illustrates the points obtained starting with a phonograph needle, the fineness of which would be impossible to obtain by any mechanical means, which, in addition, would always leave micro ridges[85]. The process devised by the *Bell Telephone Laboratories* for the preparation of points of tungsten of high quality[86] depends upon electrolytic polishing.

Electrolytic polishing has recently been recommended for the preparation of aluminum surfaces prior to welding with the normal alloy of tin. The process is most interesting for wires[87].

(References will be found at the end of the series.)
(To be continued)

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Practical Yellow Gold Plating

By Jerome L. Bleiweis, *North Hollywood, Calif.*

Introduction

DECORATIVE yellow gold plating is one of the oldest plating arts. The ease with which gold plating from the cyanide bath is performed is indicative of the fact that gold plating should have been and was, commercially exploited during the period of the plating stry's infancy. Many plating shops which specialize in gold plating have been and are operating on minimum investments, with small pots (as small as 1 gallon in capacity), with literally no solution control, and with practically no employment of modern plating methods, and techniques. Yet these shops produce good work with very little difficulty, and with great consistency, except where the question of rigid color control is involved.

Frequently, color control in gold plating is not very important. On novelty and costume jewelry work, particularly the inexpensive items, almost anything which by any stretch of the imagination looks yellow will pass for yellow gold, so long as the color is uniform and the general specular effect of the surface is acceptable. As a matter of fact, when "gold" is specified on many inexpensive items, the plater will very often brass plate the work and then spray a clear lacquer, to which has been added a gold dye, on the brass plated work to produce a gold color which simulates one or another conception of yellow gold.

Where color control is required, either on more expensive work or by a customer who will not be satisfied unless he sees a color which he decides is gold, the situation becomes more troublesome. This troublesome situation becomes doubly complicated by the fact that each manufacturer, from having observed the host of prevalent but widely different shades of yellow color, has through devious psychological processes drawn his own conclusions about what a "yellow" gold color should be. Therefore the job plating shop may find that it is producing gold plated work for several different customers, each of which has his own idea, differing from the others, of what a yellow gold plate should look like.

There are three solutions to this problem, each of which may be practical for a specific customer. The first is to re-educate the customer. By convincing him that what is coming out of the bath is really yellow gold and that his conception of a yellow gold color is erroneous, it may be possible to force acceptance of the shade which is being sold to him. This will not be difficult if the specular reflectivity or whatever other surface appearance is desired, is of high quality. There is a prevalent misconception about gold plating which holds that gold plates out of the solution on any kind of surface to produce a highly lustrous yellow plate. As a matter of fact, the author has frequently had to show dubious users of gold plated products that gold plated from a "flashing" bath plates dull where any substantial thickness is involved and that the brilliant specular effect is a function of the previous surface preparation.

Of course, it is important in re-educating the gold plate user that he really be shown the correct yellow color, or else subsequent difficulty will arise anyhow. The 24K yellow gold color resembling massive yellow gold is that color which is produced from a brand new gold plating solution of the simplest type:

Potassium gold cyanide	½ oz/gal
Potassium cyanide	½ oz/gal

The correct yellow color which may be used as a standard is that color which deposits on a freshly bright-nickel plated plane surface from the above new bath operated at about 140 degrees F at 2 to 6 volts. After the bath has been worked for a while, or if carbonate has been added, closer control than that specified above will be required for good yellow color production. The yellow color produced will be rich in color, with a suspicion of an orange or brown cast but with no evidence of a pinkish or reddish cast.

The second solution to the chaotic color problem is to plate whatever shade the customer requires. This of course may be difficult, but within litmits it will be entirely possible. A whole host of "tricks" are available to the plater who is familiar with the color characteristics of the gold "flashing" bath under different conditions. By applying this knowledge a number of shades is possible from a single bath. These color characteristics will be described in one of the following sections.

The third solution to the problem is one which will rarely be applicable. It involves the use of the karat plating solution to produce the desired color. However, few customers will be encountered who will agree that a given garat gold color is what comes out of one of the equivalent karat plating baths. As a matter of

fact, the only examples of this type of color confusion result from the fact that the customer may have been receiving plated work from a highly copper-contaminated solution and may therefor demand the pinkish hue which he has come to associate with gold.

Plating Solutions

Flash yellow gold plating is conducted in a cyanide solution of the type specified above. The metallic gold concentration equivalent to ½ oz. per gallon of potassium gold cyanide is 10 grams per gallon. This concentration is the result of a compromise between the desirability of increasing the gold concentration to a point where optimum practical operation will result, and the desirability of decreasing the gold concentration to minimize dragout losses, losses which are very expensive with gold at between 35 and 40 dollars per ounce depending upon the form and quantity in which it is purchased. At 10 grams per gallon, each cubic centimeter, which is roughly equivalent to twenty drops, is worth about one third of a cent in gold. It is possible to make up the new bath using only 5 grams per gallon and operate very efficiently. The addition of up to 1 ounce per gallon of potassium carbonate to a new bath will improve the throwing and covering power of the solution somewhat. However, this addition is not necessary unless the work is very intricately shaped, for the throwing power is usually good enough without it. Where shapes are not intricate and it is observed that good covering is being achieved without the addition of the carbonate, it is preferable to omit the carbonate. Carbonate will continually build up in a gold bath anyhow as a result of the oxidation of the cyanide. An "old" bath with a large excess of carbonate will begin to deposit gold having a distinct rose hue, at which point the bath should either be discarded and sent out to the refiner or the carbonate should be precipitated. The addition of carbonate at the outset has the effect, therefore, of reducing the life of the bath.

The "new" yellow gold "flashing" bath is operated at 130 to 160 degrees F., 2 to 6 volts, and requires anodes of stainless steel, although Nichrome and gas carbon may be used. The solution is contained in a porcelain or glass lined tank or in a stainless steel tank, the latter being preferable.

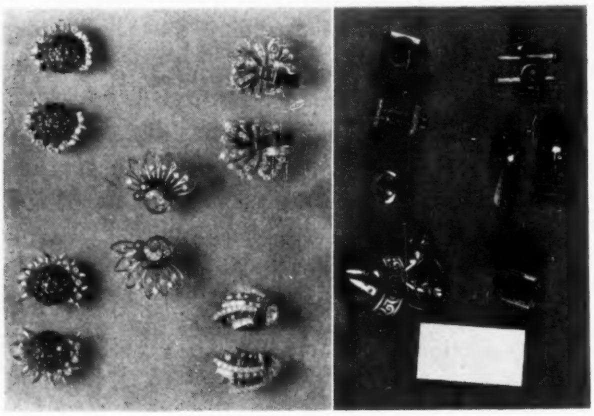


Fig. 1—A considerable amount of yellow gold plating is performed on small costume jewelry items.

The karat gold plating solutions which are in use in industry are solutions which are formulated to produce shades which resemble some of the massive karat gold colors. By composition they run between 19 to 22 karat gold even though they may be described as, let us say, "a 14 karat plate." The karat solutions are mentioned briefly in passing in order to indicate their availability when certain gold color requests are received by the plater, and to indicate the use of some alloys as undercoats or "preplates" for the final yellow deposit.

"White" gold deposits producing pale yellow to white plates are available and are essentially nickel-gold or tin-gold alloys. Green gold deposits are alloys of gold and silver or gold and cadmium. The widely used pink gold deposits, producing a whole range of pink shades depending upon the bath composition and operating conditions, are deposited from cyanide solutions of gold and copper, or gold, copper, and nickel. Currently very popular are the alloy gold plates of all kinds of shades generally called "Hamilton" Gold. These are usually pale yellow deposits of gold and nickel or even lilac deposits of the gold-zinc type. It is impossible to classify the Hamilton shades. There are literally hundreds of them. The usual approach to a Hamilton gold job is to request a sample of the color required and then construct a bath to match the color.

Operation

Yellow gold solutions are operated hot, as specified above. In order to assure uniform temperature throughout the bath, the gold tank or pot is often immersed in a water jacket which is heated. The gold tank is thereby heated uniformly by the transfer of heat from the water jacket. This is not absolutely necessary, but the added installation of a water jacket is a minor one, particularly for small tanks, and the additional operating latitude which is provided makes its use advisable. Once the work reaches the gold bath, the gold is deposited by simply striking the work rod quickly a number of times with the wire or rack from which the work is suspended, moving the work back and forth or up and down while this is being done, until the color of the metal upon which the gold is deposited is completely obliterated. The number of "strikes" against the work rod and hence the plating thickness will be a function of the color of the undercoat. For example, more gold will be required to completely cover nickel than to cover brass, or a yellow preplate. The thickness of the flashed decorative plate will vary from about one millionth of an inch (.000001) to about four millionths. Some work requires a heavier gold plate in order to meet various acid test specifications. Some manufacturers will specify seven millionths as a minimum thickness and ten millionths as a maximum (deposits exceeding ten millionths of an inch are taxable as jewelry). However, by and large, there are no thickness specifications, the criterion being only the specular quality and the color of the deposit.

The cycle of operations will differ somewhat from metal to metal and will also depend upon specific requirements. A number of typical plating cycles for various basis materials are as follows:

Brass (Color Buffed)

A—Alkaline clean and rinse
B—Pickle and rinse
C—Cyanide dip and rinse
D—Flash gold, rinse, and dry
E—Lacquer

or

A—Alkaline clean and rinse
B—Pickle and rinse
C—Bright nickel plate and rinse
D—Flash gold, rinse and dry
E—Lacquer (optional)

or

A—Alkaline clean and rinse
B—Pickle and rinse
C—Bright nickel plate and rinse
D—Flash brass plate and rinse
E—Flash gold plate, rinse, and dry
F—Lacquer.

Steel (Polished with 220 Grease Wheel)

A—Alkaline clean and rinse
B—Pickle and rinse
C—Copper or brass plate and rinse
D—Color buff
E—Repeat A and B
F—Flash brass or nickel plate
G—Gold flash, rinse, and dry
E—Lacquer unless nickel plated

or

A—Alkaline clean and rinse
B—Pickle and rinse
C—Bright copper plate, rinse, pickle, and rinse
D—Bright nickel plate, and rinse
E—Flash brass plate and rinse
F—Flash gold plate and rinse and dry
G—Lacquer

or

Omit step E and G becomes optional.

Zinc Die Castings (Color Buffed)

A—Alkaline clean and rinse
B—Pickle and rinse
C—Bright copper plate, rinse, pickle, and rinse.
D—Bright nickel plate and rinse
E—Flash brass plate and rinse
F—Flash gold plate, rinse, and dry.
G—Lacquer

or

Omit E and G becomes optional.

Aluminum (Buffed Before A)

A—Alkaline clean and rinse
B—Pickle and rinse (Pickle in nitric acid, 20-50%)
C—Zincate immersion and rinse
D—Copper plate and rinse, pickle, and rinse
E—Nickel plate and rinse
F—Flash brass plate and rinse
G—Flash gold plate, rinse, and dry
H—Lacquer

or

Omit F and H is optional.

Fig. 11.—Holloware articles are frequently gold plated or brass plated and gold dye lacquered.

Lead Base Alloys (Buffed Before A)

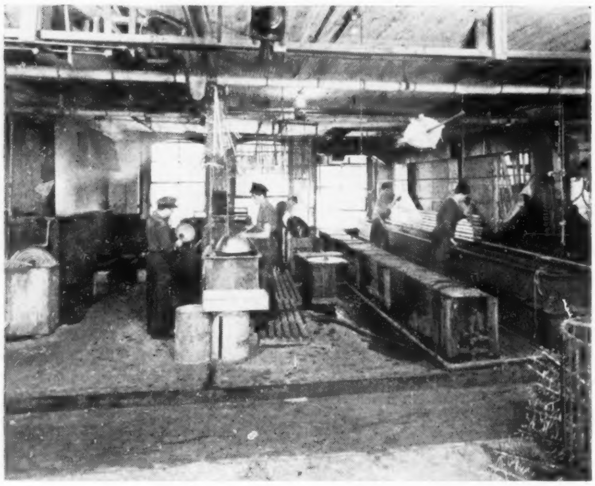
A—Alkaline clean and rinse
B—Pickle and rinse
C—Flash copper (optional) and rinse, pickle, and rinse
D—Bright nickel plate and rinse
E—Flash brass plate and rinse
F—Flash gold plate and rinse and dry
G—Lacquer

or

Omit E and G is optional.

Instead of using brass plate as a preplate for gold in any of the above, a hard alloy gold preplate may be used. Where the alloy gold preplate is used on nickel, the lacquering step becomes optional. The advantage of the use of the hard preplate is that when 24 karat gold, a soft metal, is eroded away, the still yellow, harder and more erosion resistant preplate is exposed rather than the altogether differently colored nickel plate. By "optional" is meant that the lacquer coating is not required for "tarnish" resistance. The "tarnish" resistance of gold on nickel or gold on gold preplate on nickel deposits is excellent. The lacquer may be applied in these cases for additional erosion resistance or as a "non-fingerprinting" coating. Frequently, however, the customer does not request lacquer or even specifically prohibits the use of a final lacquer coat. The reason for refusing a final lacquer coat is that no matter how good a lacquer is, or no matter how well it is applied, the effect of a final clear transparent organic coating is to reduce the luster of the surface somewhat. The most brilliant effects are obtained where bright nickel, colored or uncolored, is the undercoat and gold is the final deposit without any organic coating at all.

The advantage of using a brass deposit as a preplate is evident. Less gold is required to "hide" the brass than a "whiter" metal, and a saving is thereby effected. However, the work must then be lacquered. The advantages of the brass plate and lacquer schedule must be balanced against the gold on nickel cycle for each job to correctly evaluate its usefulness. Generally speaking, where the parts are small or otherwise difficult to spray or dip lacquer, or where the



(Courtesy Philip Sievering, Inc., New York City)

Fig. III.—Electroplating of plastics and other non-metallics. The final coat is frequently gold, deposited for decorative applications.

reduction of specular reflectivity is undesirable, the gold on nickel cycle is preferred. Where the parts are large or so intricate as to provide a large surface area, the brass plate, gold, and lacquer cycle may be preferable. As a matter of fact, on some jobs, unless this letter schedule is used, the amount of gold deposited directly on the nickel will be enough to preclude any kind of profitable operation. A further consideration in the use of a brass preplate or in the introduction of brass, bronze, or copper into the gold plating solution is that these non-ferrous materials will displace gold from the gold plating bath by immersion, and in doing so, as is characteristic in immersion plating, copper and zinc will dissolve in the bath. As these impurities build up they begin to deposit with the gold and affect the color of the deposit. Consistent "pinkish" deposits from a gold plating bath are a sign of copper contamination. This source of contamination is eliminated by the gold on nickel cycles.

Contamination of the gold plating solution is something which should be prevented much more carefully than contamination of other common plating solutions. The ordinary copper or nickel plating solution has a metallic content of anywhere from 75 to 1500 grams per gallon of solution. Gold, on the other hand, is present in its plating solution in concentrations of 4 to 10 grams per gallon. This concentration is almost equivalent to the impurity concentration in a bright nickel plating solution! Obviously the introduction of metallic impurities, in a bath having so low a metallic concentration to start with is going to produce undesirable results relatively quickly. To retard this, it is customary before gold plating to rinse in a clean running rinse provided specifically for this purpose. In this way impurities which are detrimental to the gold bath are maintained at a low level.

After gold plating, in order to save the concentrated dragout, which is worth about one third of a cent per cubic centimeter of solution, the work is rinsed in one or two still dragout rinses and then finally in the running rinses. Whenever the level of the gold plating solution is to be raised, dragout water is used. In this manner, the gold wasted down the drain is held to a minimum.

Drying

Drying of gold plated work is frequently a problem, particularly where lacquering is required. The work must come out "water stain" free and therefore must be force dried in some manner. This may be accomplished by rinsing the work in a final clean hot rinse and then "drying off" in clean, warm, dry platers' sawdust. Sometimes pieces of sawdust stick to the work or become entrapped in grooves or crevices. A method of drying which has proven successful on many parts involves the following procedure:

1—Rinse in running water.
2—Immerse in an emulsified oil mixture.
3—Vapor degrease in chlorinated solvent.

The emulsion mixture displaces the water and is then removed in the degreaser, leaving a clean, dry surface. Work to be left unlacquered may be dried in sawdust after a hot rinse or after a dip in a "water-break" wax-base soap solution, followed by a hot rinse.

Color Control

Maintenance of a uniform yellow color will be simple if the following directions are adhered to:

Assuming that the gold plating tank holds ten gallons, the amount of potassium gold cyanide required to provide a metallic gold concentration of 10 grams per gallon will be 5 oz. About 5 gallons of water are added to the tank (de-ionized water, if possible) and heated to 140 degrees F. Five to six oz. of potassium cyanide are dissolved in the hot water and then $2\frac{1}{2}$ of the 5 ounces of potassium gold cyanide are added. This produces a bath having a concentration of 5 grams of metallic gold per gallon. The work may be plated at 2 to 6 volts in the solution at this point and the color will be the desirable rich yellow gold. The bath maintained at this concentration is very economical to operate, in terms of gold loss. The cyanide concentration represented by the potassium cyanide should be maintained at at least $\frac{1}{2}$ ounce per gallon. A higher concentration will not be detrimental. Daily additions of $\frac{1}{4}$ to 1 ounce of potassium cyanide to the tank will be required to replace the cyanide oxidized to carbonate.

From the point of view of the maximum plating rate, the work rod tapping should proceed at 6 volts until the first sign of a paler color appears. In the normal course of events the paler yellow won't appear for several days. As soon as the pale yellow color appears, the tank voltage should be dropped to 3 volts and the plating thenceforth carried out at that voltage. At the first sign of gold depletion, the remaining $2\frac{1}{2}$ ounces of potassium gold cyanide should be added to the bath. Plating at 6 volts may be resumed again. This time, however, the paler hue will appear sooner. This is probably due to the increase in the carbonate concentration in the bath. The plating may again be carried out at 3 volts although the quickest procedure at this point will be to tap the work rod a few times at 6 volts and then deepen the yellow color by tapping a few more times at 3 volts. This procedure is then continued until depletion of the gold is again in evidence. At this point, more potassium gold cyanide may be added and the plating continued at a 6 volt

trike and a 3 volt color. After a total of 10 ounces of potassium gold cyanide have been introduced into the tank, it becomes more difficult to maintain the yellow color. This is due either to impurity build up, or carbonate build up.

The color of the deposit at this point will vary from a very pale yellow, at the high voltage, to a very "pinkish" yellow at the low voltage. At this point, if the consistently rich yellow color is what is desired, the bath should be discarded and sent to the refiner or used as the basis for a preplate or initial shading solution.

If varying shades of color must be provided for certain customers, the old bath can be set aside for this purpose. At six volts, the color thus obtained is almost a perfect match for some of the Hamilton gold shades. It is possible to use the color obtained at this voltage as a Hamilton color. These paler shades are also widely accepted as yellow gold by many users of gold plated articles. At the lower voltage, after a strike at six volts, the reddish color may be just what some other customer wants. Through the correct utilization of both the "old" bath and a new bath, shades of yellow gold may be obtained of which there will be one for almost any request. Where the rich yellow is required, the new bath will produce it. Where some of the off shades are requested, the old bath will probably be in a position to produce them. Only experience with the plating solutions operated in the manners described above will enable the plater to produce the great variety of shades producible. The plater literally becomes an artist deftly producing one shade or another.

Where a yellow gold color is required but with a somewhat pinkish cast, not quite as pink as pink gold but pinker than yellow gold, the trick sometimes used is to flash plate copper as an undercoat and then yellow gold plate over the copper, the thickness of the gold held below the point where the copper color is completely obliterated.

Plating Difficulties

As was stated previously, yellow gold plating is exceptionally simple to perform barring fussy color matching. There are relatively few clinical difficulties. Many plating aberrations which show up in the course of gold plating and which are due ostensibly to trouble in the gold plating process are frequently found to be ascribable to some aspect of the finishing process previous to the gold plating stage. These difficulties would not be correctly classified as gold plating troubles. The following example of an aberration of this type will illustrate the point:

A large plating shop was called upon to gold plate zinc die-cast brush handles. The casting was intricate particularly along its length where the design simulated a kind of recessed grill work. The procedure used by this shop was as follows:

1—Cut with tripoli
2—Copper Plate
3—Bright nickel plate
4—Fan the nickel
5—Preplate
6—Gold plate
7—Lacquer

A great deal of difficulty arose from the fact that the gold color in the crevices of the grill work was different (redder) than the color over the rest of the piece. Various procedure modifications were attempted, but to no avail. Finally the author worked out the following successful procedure:

1—Cut and color die-casting
2—Bright copper plate
3—Bright nickel plate, for a long enough period so that subsequent fanning of of the nickel would be eliminated
4—Preplate
5—Gold Plate
6—Lacquer.

As long as the work was taken from the nickel plating solution without interruption for fanning and processed through the gold plating stage, uniform color was attained. Nickel plating rejects requiring coloring or fanning were cathodically cleaned after the wheel operation, then flash nickel plated and then processed as before.

The plating aberrations which may be ascribed to gold follow:

I—Inability to Cover the Undercoat Due to Inordinately Thin Deposits.

A—This may be due to the lowering of the gold content of the bath to the point where it behaves like a depleted solution.
B—Exceptionally high current densities particularly where agitation of the work is omitted may be responsible.
C—Low plating bath temperature will result in thin deposits.

II—Off-Colors

A—Metallic impurities in the solution.
1—Copper-pinkish to red
2—Nickel and tin-white
3—Zinc-white to a lavender-like color
4—Cadmium and silver-greenish
5—Lead-grey to blackish
B—Poor cleaning.

(Courtesy Philip Sievering, Inc., New York City)

Fig. IV.—Lacquering of gold plated articles is required where the gold is deposited directly upon brass or upon a brass undercoat.

C—Plating on passivated or partially passivated surfaces.

D—High carbonate content—characteristic of a well worked bath (see Color Control above)

E—Bunching work too close together in the gold plating bath.

F—Striking the anode during plating.

G—Poor anode to anode rod electrical contact.

H—Staining after or during drying—in this case the off color stain is easily removed by burnishing with a soft cloth.

I—Thin deposits not hiding the underlying metal completely.

J—Soap contamination of the plating solution.

From the nature of the above, it is readily evident that the prevention of most of them involves a relatively perfunctory amount of attention to good plating shop practice.

Heavy Gold Plating

Heavy industrial gold plating of the non-decorative type finds application commercially for any of the following purposes:

1—Resistance to tarnish and attack by chemicals.

2—Resistance to oxidation at elevated temperatures.

3—Plating of laboratory apparatus for protection against corrosive fumes.

4—Infra red reflection.

5—Low electrical contact resistance.

6—High uniform surface electrical conductivity.

The plating bath formula may be as follows:

Potassium gold cyanide (67.5% salt)	3 to 4 oz/gal
Potassium cyanide	7 to 8 oz/gal
Potassium hydroxide	½ to¾ oz/gal

The bath is operated at 130 to 160 degrees F, using a current density of 4 to 10 amps per square foot. The work should be agitated during plating. Anodes may be of stainless steel, gold or a mixture of stainless steel and gold anodes. If the solution is regularly analyzed and close control is maintained, the use of stainless steel anodes with periodic additions of potassium gold cyanide is preferable to the use of gold anodes. Gold anodes are disadvantageous in that they may be stolen, they may dissolve too rapidly resulting in an overly high metallic content, they contribute to spongy deposits unless the free cyanide is rigorously controlled, and pieces of the anode frequently fall into the tank.

The plating rate is somewhat less than 0.001′ per hour at normally applied current densities. At 6.2 amps per square foot and 100% cathode current efficiency the plating rate would be 0.001 inches per hour.

Normal trouble free operation is easily effected in heavy gold plating. The higher metallic gold content, as high as 80 grams per gallon of solution, puts the bath in the same class, so far as operation characteristics are concerned, with the conventional hot copper cyanide plating bath. It is advisable to include two still dragout rinse tanks in the post plating cycle in order to save considerably the wasted washings finally going to the drain.

Barrel Gold Plating

Yellow gold may readily be barrel plated, either from the dilute flashing baths or the more concentrated industrial plating baths. Completely enclosed barrels wherein the solution is ladelled into the rubber lined barrel containing the cathode contacts at their base, and anodes suspended in the solution, or small utility type perforated barrels suspended in the gold tank from the work rod, are used.

Small parts which have been barrel gold plated are generally ball burnished with steel shot burnishing soap and water if a high luster is desired on the final product.

Conclusion

Yellow gold plating, one of the oldest commercial plating processes, is characterized by its simplicity and versatility of operation except where rigorous color control is involved. The simplest types of plating solution are the cyanide gold baths, of low metallic content for decorative purposes and of higher metallic content for heavier industrial electrodeposits. Either solution is operative as a still tank or barrel plating solution with excellent results in both cases.

Color control in the flashing bath is effected by means of proper voltage control, taking into consideration the metallic content and age of the plating solution. Practical color control is an art requiring an experienced operator. The experienced operator will be able to produce a host of different shades to meet different requirements by properly exploiting the possibilities of the "new" and the "old worked" gold plating solutions. Color control of the most extensive type utilizing all of the shading possibilities cannot be achieved by simply following written directions. A kind of "feel" is developed with the practical operation of the bath. It is hoped that this article will serve to illuminate the path somewhat toward the attainment of the widest possible color control.

Radioactive Tracers Used to Study Plating Process

Abstract of National Bureau of Standards Technical Report 1399.—ED.

A BETTER understanding of the mechanism of electrodeposition in chromium plating has resulted from recent studies* by *Fielding Ogburn* and *Abner Brenner* of the National Bureau of Standards, using radioactive tracer techniques. By tagging either the trivalent or the hexavalent chromium ion in a chromic acid plating bath with radioactive chromium 51, it was conclusively shown that metallic chromium is deposited out of the bath from the hexavalent state rather than from the trivalent state, as had previously been suggested. In addition to solving a long-standing problem in electrochemistry, the Bureau's work has demonstrated the utility of tracer methods as a tool for research on industrial plating processes.

Chromium plating is widely used to provide a hard wear-resistant coating on machine parts and for decorative purposes on such products as automotive grillwork and bathroom fixtures. For commercial plating of this kind, the chromic acid bath, first reported in 1856, is at present practically the only chromium plating solution in use. This bath is prepared by dissolving chromic acid anhydride (CrO_3) and a little sulfuric acid in water. Initially, all of the chromium in the solution is in the heavalent state; but when the plating current is applied, an excess of some trivalent chromium is formed by reduction of the heavalent chromium at the cathode. This has led to numerous investigations into the mechanism of the electrodeposition process to determine whether the chromium is deposited directly from the hexavalent state or through the trivalent form. Several supporting arguments have been advanced by advocates of each theory of chromium deposition, but until now neither hypothesis had been conclusively proved. The National Bureau of Standards therefore undertook to determine experimentally the source of the electrodeposited chromium by use of radioactive tracers.

Five chromic acid plating baths were prepared, and a small quantity of radioactive trivalent chromium was added to two of the baths as chromic chloride ($CrCl_3$) while hexavalent chromium was added to the other three baths as radioactive chromic acid anhydride (CrO_3). Chromium deposited from the first two baths was inactive. On the other hand, deposits from the baths in which the hexavalent chromium was tagged were found to be radioactive, and their activities were close to those of deposits from a bath containing active hexavalent chromium and no trivalent chromium. It was thus evident that the metal is deposited from the hexavalent rather than the trivalent state.

The solution of radioactive chromic chloride was prepared from small pellets of chromium metal containing a minute quantity of chromium 51. The pellets were weighed and dissolved in hydrochloric acid. Excess acid was removed by evaporating to dryness, and water was added to the residue.

Radioactive hexavalent chromium was prepared by adding hydrogen peroxide and sodium hydroxide or ammonium hydroxide to a portion of the solution of active trivalent cromium and heating the mixture on a steam bath. When all the chromium had been oxidized to chromate, the solution was evaporated to dryness to remove excess ammonium hydroxide and hydrogen peroxide. The residue was then dissolved in water.

The deposit from the plating bath was made on brass tubes 1 in. in diameter and 10 in. long. Each tube was supported vertically inside a cylindrical porous cell within a liter beaker. The anode was a cylindrical sheet of lead that fitted the inside wall of the beaker. The porous cell served to prevent anodic oxidation of trivalent chromium during the electrolysis. Chromium was deposited at a current density of about 30 amp. per sq. dm. for intervals of 5 to 7 minutes, and the weight of the deposit was determined by weighing the cathode before and after plating.

Chromium 51 is a soft gamma ray emitter with a half-life of about 26 days. Its radioactivity in the solutions and the deposits was measured by means of a thin-walled glass gamma ray counter connected to a scaler. At the end of the plating process the Geiger counter was placed within the brass-cylinder cathode and the activity of the deposit was counted for 30 minutes. The tube was then rotated through 180°, and counting was continued for another 30 minutes. A background count was also made with an unplated brass tube for the same period of one hour and was subtracted from the count for the plated tube.

Isotopic exchange frequently takes place between different valence states of the same metal. Had it occurred in the Bureau's investigation to any appreciable extent, it would have resulted in the presence of sizable quantities of both active trivalent and active hexavalent chromium in the plating bath, regardless of which was added. This would have made it impossible to draw any valid conclusions from the experiment. It was therefore necessary, before performing the experiment, to determine the extent to which isotopic exchange takes place between trivalent chromium and chromic acid in the plating bath.

A stock solution containing both trivalent and hexavalent inactive chromium ions in fixed proportions was divided into two parts. To one part, active hexavalent chromium was added as chromic acid; to the other, active trivalent chromium was added as chromium chloride. These solutions were kept at 50°C for one hour, and at intervals 5-ml samples were taken from each solution. The hexavalent and trivalent chromium in each sample were separated chemically, and the activity of each fraction was measured. The activities of the two fractions of each sample showed that at the end of an hour a small portion of the tracer had undergone an isotopic exchange, but not enough to interfere with the investigation.

* *For more complete details, see "Experiments in Chromium Electrodeposition with Radioactive Chromium," by Fielding Ogburn and Abner Brenner, J. Electro Chem. Soc. 96, 347 (1949).*

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Luminescent Finish for Fish Lures

Question: We are sending you a sample part (fish lure) which has been given some sort of a finish which resembles pearl, and has a rainbow affect when turned to the light in various directions. Can you give us any idea what sort of a finish this is?

J. L.

Answer: This sample part has been finished by a process known as Patternplate, as developed and marketed by United Chromium, Inc. You can obtain complete details of the process by communicating directly with this firm.

Rhodium Plating Over White Gold

Question: We are sending you a sample of rhodium plated work over white gold filled (1/20-12Kt.) nickel base metal. You can see the spots which appear on the finished work. Our cleaning cycle consists of a clean in ammonia water (hot), rinse, throw clean, rinse, and rhodium plate. We would appreciate any information you can give regarding overcoming this problem. Do you think nickel plating before rhodium would help?

S. F.

Answer: Examination of the sample part shows definitely that your cleaning procedure has not produced a surface that is sufficiently clean for subsequent plating, as there are many small bare spots where plating has not taken place, in spite of a good deposit elsewhere on the piece. We would suggest an electrocleaning step, followed by a dilute acid dip, in your cleaning cycle. If properly done there is no reason why you should not obtain good coverage from the rhodium bath. It is not necessary to nickel plate white gold alloys before rhodium. The primary purpose of a preliminary nickel plate before rhodium is to prevent tarnishing of the base metal under the rhodium, due to the porous nature of the thin rhodium film. As white gold is in itself a tarnish resistant metal, there is no need for nickel plating over it.

Non-Plating of Copper in Barrels

Question: Recently we tried plating copper on several batches of steel screws in our regular barrel equipment. We had done a lot of similar work before, but with this particular job we found that we could not seem to throw any copper onto the parts that were on the inside of the barrel load. We tried plating for a longer time and using higher current, but this does not seem to help. Can you tell us what may be causing our difficulty?

T. F. N.

Answer: Your trouble is probably in the fact that you are loading the barrels too much for this particular type of part. As most of the current is conducted through only the exposed areas of the parts, the center portions of a heavily loaded barrel cannot receive any deposit, as they probably never find their way to the surface of the load. Putting fewer parts in at a time will overcome this trouble. It is also possible that your free cyanide content is too high, in which case the deposit is dissolved off the parts on the interior of the load as fast as it can be deposited on them during the short time they are on the surface receiving a deposit.

Nickel-Chrome Plating on Steel

Question: We recently came across a specification for plating on steel, referred to as K. S. plating. We have never heard of this before and would appreciate any information you can give us.

R. W. J.

Answer: Type K. S. plating refers to an American Society for Testing Materials specification, A 166-45T, for nickel-chrome plating on steel. A complete set of ASTM specifications for plating which lists this and other types of plating for various base metals may be obtained from the ASTM, 1916 Race Street, Philadelphia 3, Pa., at $1.00 each.

Black Finish on Aluminum

Question: We are interested in putting a black finish on some small aluminum die castings and wonder if you can furnish any formulas for doing this.

S. H. C.

Answer: A solution which would produce a black finish on aluminum parts is made up as follows:

Amonium molybdate	10-20 grams
Sodium acetate	5-20 grams
Ammonium chloride	5 grams
Water	1 gallon

Immersion time is about a minute, after which the parts are then thoroughly rinsed. A much more durable black may be obtained by anodizing and dyeing the parts. Another method which could be used would be to put a fairly heavy copper plate on the parts and then blacken the copper coating similar to the method for blackening brass and copper. The names of suppliers of proprietary baths for blackening copper alloys is being sent to you.

Cleaning Out Exhaust Ducts

Question: We are troubled by an occasional breaking out of fires in one of our polishing room ducts. We are not doing anything of a special nature which would cause this and wonder if you can tell us what remedies may be applied as we imagine this must be

...her a common problem in the polishing business.

G. L. P.

Answer: The safest way to eliminate this type of trouble is to have a thorough cleaning out of all exhaust ducts, thus preventing both spontaneous combustion from grease soaked buffing lint or occasional sparks. Such cleaning out should be done at least once a week and oftener if required. Good housekeeping is an essential part of preventing such occurrences.

Oxidized Bronze Finish

Question: We are interested in producing a special finish known as "dull oxidized oil rub". We understand it was used extensively on builders hardware and we would appreciate knowing the procedure to follow in producing this finish.

Y. W.

Answer: The special hardware finish known as oxidized oil rub finish is produced on bronze (red brass) or bronze plated surfaces which have been wheel finished with a very fine satin or butler surface. This surface is then oxidized to a dark color in any one of the usual sulphur oxidizing solutions and after drying is hand rubbed with a soft cloth soaked in linseed oil. Some practice may be involved in obtaining the proper amount of blackening, as the final finish should be quite a bit darker than the usual oxidized and relieved type of finish. No final lacquer coating is used after the oil rub. Samples of most standard hardware finishes may be obtained from the *National Bureau of Standards, Commodity Standards Division, Washington* 25, *D. C.*

Silverplating Holloware

Question: In plating silver holloware we are having difficulty with the disappearance of the silver plate in deep recesses and insides of the bases when the voltage is reduced below 1 volt, which seems to be necessary in our application to prevent streaking from engraved areas. The difficulty is not present on other flatware. The plating appeared at first when we plated from 1½ to 2 volts, but as soon as we reduced the voltage to below 1 the silver disappeared again. Can you tell us what is causing this?

R. A. M.

Answer: The reason for the silver plate disappearing from the recesses and insides of holloware when the voltage is cut way down is that the current density in these areas is then reduced to a point which is too low to counterbalance the chemical solution effect of the cyanide in the bath on the thin silver deposit. One way to overcome this would be to reduce the free cyanide content in the bath. Another would be to use special racking methods which would create a more uniform current distribution in these recessed areas, such as a conforming or auxiliary anode. It is difficult to understand why the voltage should be reduced part way through the plating cycle, provided satisfactory plating is taking place at the higher voltage.

Chrome Plating on Plastics

Question: Is there any known method for chrome plating on plastics? I would appreciate any information you can furnish on this process.

B. P. C.

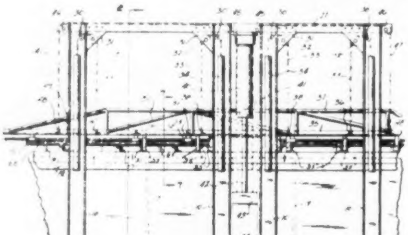
Answer: There is no reason why chrome plating of plastics can not be done. The preliminary step would be identical to the requirements for plating other metals on plastics, and would consist essentially of first getting a conducting film either by immersion in silver reducing solutions or by spraying, followed by nickel plating and then chrome plating in the usual manner. Essentially the method is quite simple, but there are a number of special "kinks" involved in sensitizing, roughening, or sealing the plastic surface, depending on its composition, as well as the actual metallizing steps. The booklet "Metallizing Non Conductors" by *Samuel Wein* contains a number of helpful suggestions along these lines.

PATENTS

Apparatus for Conveying and Immersing Articles

U. S. Patent 2,479,322. J. V. Davis, assignor to Udylite Corp.

In an apparatus for treating work by immersion, a series of receptacles,



a work carrier rail extending along said receptacles, said rail having a fixed section and a movable section, an elevator frame over said receptacles and rail, a work drive chain carried by said frame, pusher elements carried by said chain for moving work along said rail, said movable rail section being also carried by said frame, said pusher elements being in permanent functioning relation to said movable section, and means for raising and lowering said frame.

Method of Treating Phosphate Coated Surfaces

U. S. Patent 2,478,954. B. S. Tuttle & T. Navoy, assignors to J. N. Tuttle, Inc.

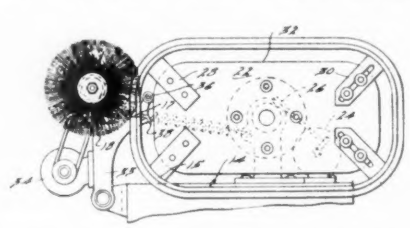
The method of treating a metal article having an insoluble metal phosphate coating thereon produced by chemical reaction of the phosphate radical with the metal surface, which comprises subjecting said phosphate coating to the action of an aqueous solution of a stannous salt which is water soluble and water stable, the solution having an acidity insufficient to strip said phosphate coating, thereby to form an insoluble tin-metal-phosphate complex having a corrosion resistance greatly exceeding the original phosphate coating.

The method of treating a metal article having an insoluble metal phosphate coating thereon produced by chemical reaction of the phosphate radical with the metal surface, which comprises subjecting said phosphate coating to the action of an aqueous solution of a stannous salt which is water soluble and water stable, the solution having an acidity insufficient to strip said phosphate coating, and a dye compatible with said stannous salt solution thereby to form an insoluble tin-metal-phosphate-dye complex having a corrosion resistance greatly exceeding the original phosphate coating and simultaneously imparting a coloration thereto.

Method of Making Bumpers

U. S. Patent 2,481,072. J. H. Brazil, assignor to Chrysler Corp.

A method of making automobile bumpers consisting in mounting a rectangular metallic annulus member having continuous inner and outer surfaces and a bonded joint substantially midway a short side thereof on a holding element by its inner surface only, polishing the contiguous portions of said continuous outer surface with a rotary brush while so held, during



said polishing continuously adjusting the relative positions of the brush and the said outer surface of the member to maintain a substantially uniform relationship therebetween whereby to uniformly polish the said contiguous portions and thereafter severing said member at the bonded joint and at the short side of the member opposite the joint to produce two bumpers.

Corrosion Resistant Coating for Ferrous Products

U. S. Patent 2,478,692. C. H. Hack, G. E. Behr & G. J. Vahrenkamp, assignors to National Lead Co.

Method for protection of a corrodible metal surface which comprises coating said surface with a metal selected from the group consisting of lead and alloys thereof with tin and antimony, said coating being of thickness between about 0.0002 and 0.001 inch, immersing said coated surface in a solution consisting essentially of an alkali metal hydroxide, an alkali metal sulphate and an alkali metal dichromate, the proportions of each being not less than 15% and not more than 40% of the total solids content of said solution, and water in amount to produce between about 30 grams and 120 grams of total solids per liter, at a temperature of from about 120° F. to 170° F. for a period of about 10 seconds to 5 minutes, removing said surface from said solution and drying the same.

Electroplating Baths and Method for the Electrodeposition of Zinc

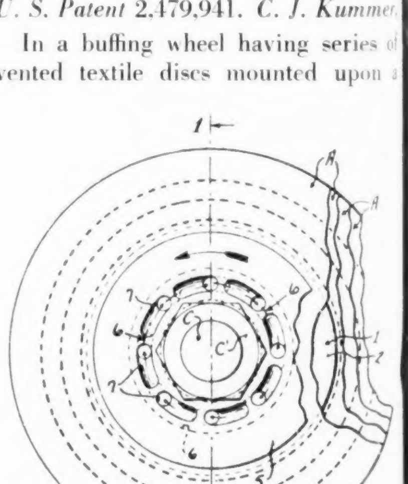
U. S. Patent 2,479,670. A. E. Chester & F. F. Reisinger, assignors to Poor & Co.

A method of electrodepositing zinc which comprises electrodepositing the zinc from an alkaline aqueous cyanide zinc plating bath having an M ratio within the range of 1.75 to 2.2 to which has been added 30 to 60 cc. per gallon of bath of the product of the reaction of an approximately 50% aqueous solution of gluconic acid containing less than 4% of reducing sugars and an aqueous alkaline solution of a chromium compound selected from the group consisting of trivalent and hexavalent chromium compounds, the ratio of the gluconic acid molecule to the chromium atoms being at least 1:1, said product existing in the form of clear green stable solutions in water, and effecting said electrodeposition at current densities within the range of 25 to 250 amperes per square foot.

Air-Cooled Buffing Wheel

U. S. Patent 2,479,941. C. J. Kummer.

In a buffing wheel having series of vented textile discs mounted upon a



shaft; a pair of clamping hubs for the discs, each having an inner circular channel engaging said disc forming air pockets, a series of suction air ports communicating with the channel pock-

ets, each port having circular openings interrupting the channel, the opening being flared outwardly and obliquely to the face of the hub to form elongated mouths trailing in the direction of rotation of the wheel, whereby the short and long walls of the said ports serve to pick up currents of air and discharge the same into the channel pockets incidental to rotation of the wheel to maintain a constant air pressure in said pockets that will discharge through the vented discs.

Device for Magnetically Determining Thickness of Coatings

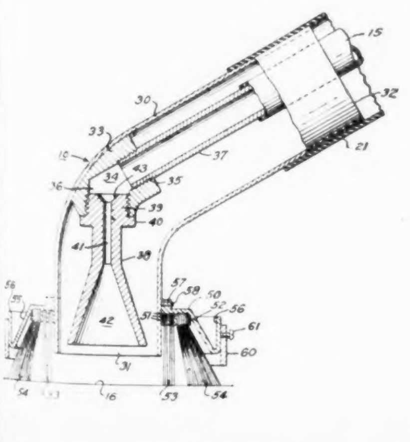
U. S. Patent 2,481,345. *M. F. Reynst, assignor to Hartford National Bank & Trust Co.*

Apparatus for magnetically determining the thickness of a layer of magnetic material, comprising a closed flux path including a core of magnetic material consisting of two concentric portions which are connected to one another at one end and including a longitudinal opening in the said inner core at the said end, a layer of the said material to be measured and a removable armature, a coil element surrounding the said inner portion and means formed of magnetic material and rotatably and longitudinally movable in the said opening to vary the amount of the total magnetic material in the said flux path positioned within the limits of the said element, the said means being independent of the thickness of the said material.

Surface Treating Apparatus

U. S. Patent 2,483,176. *L. H. Bishop and J. S. Finn, assignors to William H. Mead.*

An operating head for a blast-impelling suction-removing, surface-treating apparatus, said head comprising a hollow housing open at each end, the lower end being arranged to face the work surface and the upper end being adapted for connection with a suction line; a conduit extending within said housing and mounted therewith to provide between said conduit and said housing a suction passageway connecting said lower and upper housing ends, the upper end of said conduit being adapted for connection with a blast line and the lower end of said conduit terminating adjacent the surrounding lower end of said housing; and a maze-like impeding means depending from the periphery of said lower housing end, said impeding means comprising an inner ring of relatively stiff brush elements and an outer ring of brush elements which are relatively longer and more flexible than are those of said inner ring.



Phosphate Coating of Metallic Articles

U. S. Patent 2,479,564. *L. O. Gilbert.*

The process for forming a rustproofing coating of a metallic phosphate upon a ferrous metal surface which comprises subjecting said surface to the action of an aqueous solution the solutes of which consist essentially of free phosphoric acid, a phosphate of a metal selected from the group consisting of zinc, manganese and copper, and boron phosphate in the proportion of about one-half pound to about three pounds per about 240 gallons of said solution.

Method of Producing Black Oxide Coated Steel Sheets

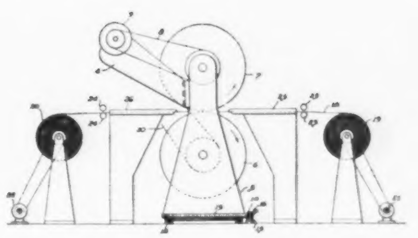
U. S. Patent 2,481,424. *J. W. Hill, assignor to Empire Steel Company.*

In a method of producing heat and corrosion resistant steel sheets, the steps which consist of applying to sheets having a blue oxide coating thereon a coating of petroleum asphalt, and igniting said asphalt whereby the asphalt burns and said blue oxide is reduced to a black oxide.

Apparatus for Grinding

U. S. Patent 2,483,277. *A. E. Hamilton.*

Grinding apparatus comprising means for directing work pieces in a given path of travel, a roll stand positioned adjacent to said path, an abrasive roll carried by said stand and mounted on an axis that extends generally transverse to said path, and means



for rotatably adjusting the roll stand to shift the roll axis in a plane parallel to the plane of the material, to thereby change the angularity of the roll axis.

Electrochemical Polishing of Tantalum

U. S. Patent 2,481,306. *J. F. Gall & H. C. Miller, assignors to The Pennsylvania Salt Manufacturing Co.*

The electropolishing of metallic tantalum by making it anodic in an electrolyte, containing 2%-7% by weight of hydrogen fluoride and 32%-38% by weight of hydrochloric acid, the combined acid concentration being between 34% and 45%, the balance being substantially water, and passing current at an anodic current density of from 40 to 160 milliamperes per square centimeter until the metal surface has developed a high mirror-like polish.

Metal Protective Coating Method

U. S. Patent 2,481,977. *L. Cinamon.*

Process of rust inhibiting a metal which comprises: pickling the metal; washing the pickled metal; and subjecting said metal, after such cleaning, to the action of an aqueous solution comprising essentially, in combination, from ½ to about 8 oz. per gallon of:

	Approximate parts
Tetra sodium pyrophosphate	10
Sodium meta silicate	4
Tri sodium phosphate	2

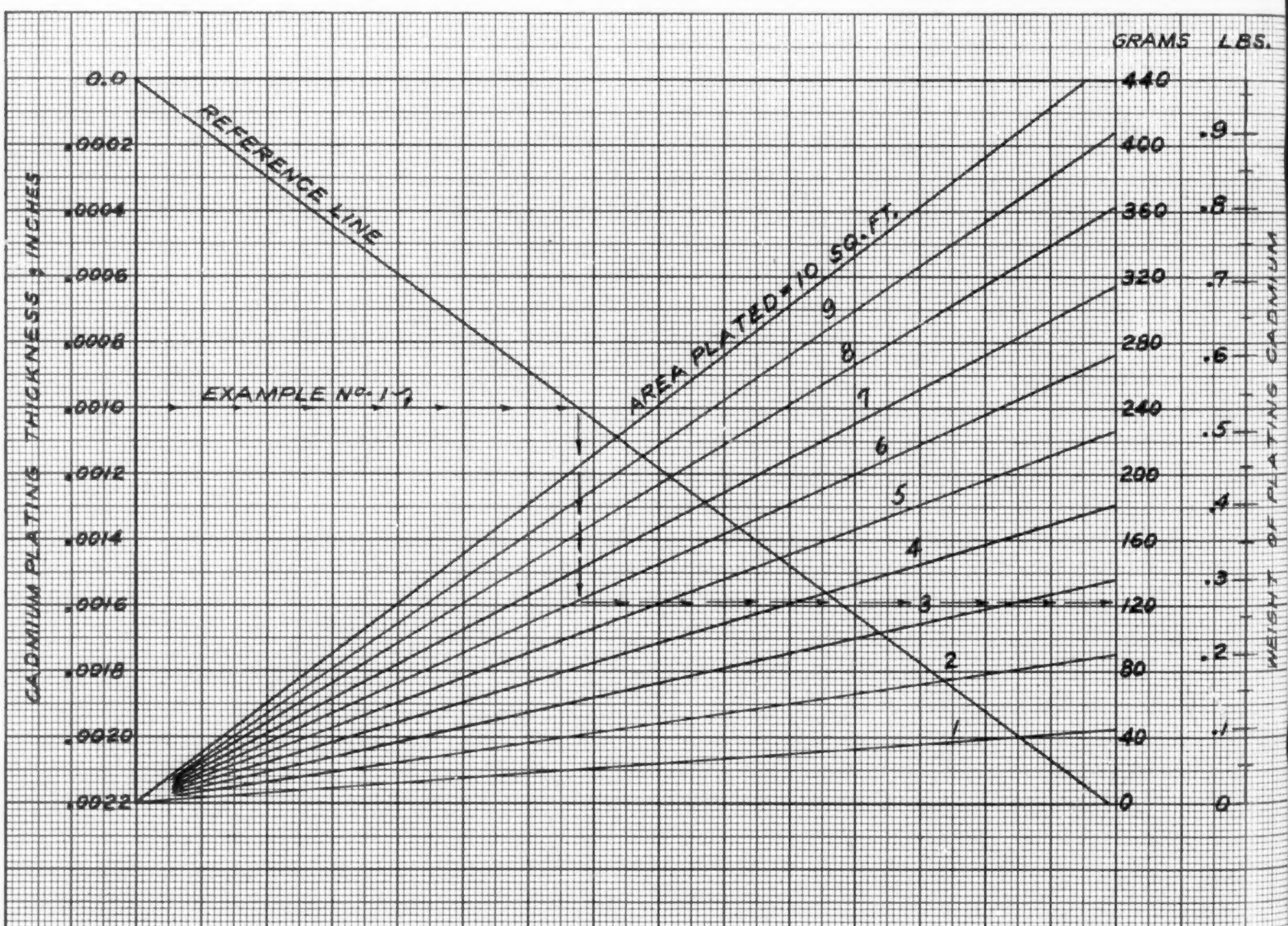
Copper Plating Solution

U. S. Patent 2,482,354. *A. M. Max and C. M. Vance, assignors to Radio Corporation of America.*

An acid copper plating solution consisting essentially of the following ingredients per gallon of solution; approximately 25 ounces to 32 ounces of copper sulfate, approximately 3 ounces to 10 ounces of sulfuric acid, and an addition agent consisting essentially of 0.1 ounce to 0.5 ounce of tri-isopropanolamine.

Calculating Metal Cost in Plating Cadmium

With the aid of the chart below it is a simple matter to calculate the cost of depositing a given thickness of plating on a known surface area. The example shown by the dotted line illustrates the method for calculating the total weight of cadmium used in plating .001" of cadmium on a surface area of 6 square feet. The total weight of cadmium is then multiplied by the present price for cadmium anodes to get the total cost. For areas larger than 10 square feet, simply multiply by the proper factor.

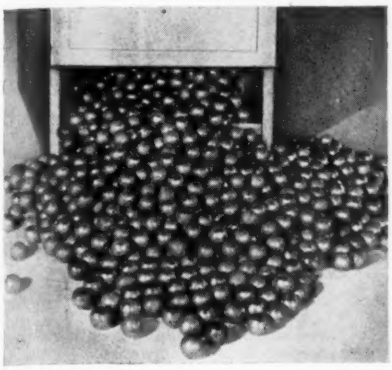


Recent Developments

New Copper Ball Anodes

Udylite Corp., Dept. MF, E. Grand Blvd., Detroit, Mich.

Introduction of a new forged copper ball anode to replace the old type cast



copper ball anode is announced by the Udylite Corporation.

These new forged copper ball anodes are claimed to offer several advantages to platers. By forging instead of casting, a finer, more even grain is obtained. It gives a purer anode and is much cleaner in the plating bath, it is said. Furthermore, all anodes are of uniform shape and weight.

The new copper ball anodes are now available for immediate delivery to any point in the United States.

Heavy-Duty Portable Dust Collectors

The Kirk & Blum Mfg. Co., Dept. MF, 2838 Spring Grove, Cincinnati 25, O.

To fill a long-felt need in industry for a heavy duty portable dust collector, this firm announces the new type "M" unit dust collector. Three models are available in 450, 900 and 1800 CFM at high velocity.

These heavy duty collectors can be set up anywhere to serve one or several machines for any period of time, or can be readily moved to meet changing needs. They eliminate the need for long, costly pipe runs to remote areas of a plant where one or a few machines are located, it is claimed.

These units are said to be of greater capacity and more efficient than smaller conventional collectors. Each unit is compact, self-contained and ready to operate. The Type "M" units handle dust from grinding, buffing, and polishing metal-working machines and similar dust sources. Each unit consists of motor, exhauster, centrifugal pre-cleaner and steel wool filter after-cleaner. In all sizes, the principles of operation are the same. The dust laden air is delivered to a small diameter, high efficiency, centrifugal pre-cleaner where all but the finest particles are removed. The air then passes through steel wool filter pads, three inches thick, for final cleaning.

Motor and exhauster are completely isolated from dust. The units are completely fire proof. Exhausters are heavy-duty industrial type, direct connected to a 3600 rpm., 220/440 volt motor. The motor is amply ventilated and readily accessible through a removable expanded metal panel. Dust receptacles are gasketed, sliding drawers, secured with a hand wheel to insure a leak-proof seal.

Where conditions will not permit the re-entry of cleaned air into the working area, the filters are replaced with air-tight closures and the air vented to the outside. Exhaust stack connections can be furnished at top or any side of the unit. Where it is desired to return the cleaned air to the building during the winter months to conserve heat and to vent it to the outside during the summer months to improve ventilation, the unit may be equipped with both exhaust stack and filters. The change is effected by merely turning a damper in the stack.

For detailed information write for Bulletin No. 17M.

Anti-Stain Addition Agent for Rinse Tanks

R. O. Hull and Co., Dept. MF, 1279 W. Third St., Cleveland, O.

This firm announces a new product known as Rins-Aid for addition to a static rinse tank. This is said to form a water-repellent film on freshly plated work and hence leaves the surface of the work virtually dry. Rins-Aid is a concentrated product added to the water rinse in the amount of about 10 oz./per 100 gal. of water. Although Rins-Aid may be used in the final rinse, it is prefered to make the addition to the rinse tank just before the last dip.

Advantages of the Rins-Aid dip are said to be virtually complete freedom from water staining of chrome, nickel, cadmium or zinc, improvement in uniformity of appearance of the surface, greater ease of drying, since the plated surface is left practically dry, and use of a lower temperature than usual in the final hot water rinse.

Grinder and Polisher for Coiled Strip Stock

Curtis Mach. Div., Lincoln Park Industries, Inc., Dept. MF, Jamestown, N. Y.

Recently introduced by this firm is their Model 600 Straight-O-Matic grinder and polisher. Designed specifically to handle any metal strip or blank material up to 10″ wide, this new 600 unit produces any desired finish from rough grind to high polish, and feds by coil winder and reel, conveyor belt, or manually. Handling anything from putty knives to 10″ wide strip, it is claimed to produce a uniform finish at production speeds never before

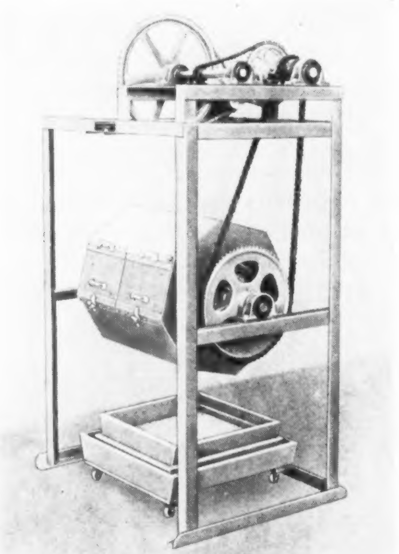
possible. The Curtis 600 Straight-O-Matic is practical for plants having diversified short run requirements and equally as efficient in those shops with long continuous runs, it is said. It can be easily set up or changed to handle various grits or, when arranged in battery, will produce in one continuous run any number of consecutive finishing operations from rough grind to high polish.

In use the machine has proved itself in operation to produce a better, more uniform finish in shorter time and at lower cost than any previous method, it is claimed. It makes possible grinding and polishing operations which heretofore have been considered either too expensive or impractical on a production basis.

Tumbling Machine

Lupomatic Industries, Inc., Dept. MF, 4510 Bullard Ave., New York 66, N. Y.

A new and improved tumbling machine has recently been announced by the above firm, manufacturers of Tumb-L-Matic processes, equipment and supplies. One of the main improvements over former models is the mounting of the bearings on the raised frame for positive direct support to all the drive mechanism. Ball bearing equipped throughout, the shaft hous-



ings are now supported by the frame itself, thus providing an even more rugged and substantial construction, it is claimed.

Chain gear drive with constant speed motor assures an unvarying steady power at all times, an essential factor in all tumbling processes. When a change of work calls for a different speed the unit can be readily converted to the speed required. All parts of the equipment are readily accessible for easy lubrication and simple maintenance.

The model pictured is especially designed to handle such processes as deburring, definning, cutting, smoothing, polishing or surfacing metals for plating, etc. Literature and prices are available on request.

Work-Holding Spinner for Polishing and Buffing

Trailer Lock and Body Co., Inc., Dept. MF, 448 N. Halsted St., Chicago 22, Ill.

This firm announces their new work-holding spinner for production polishing and buffing of round and cylindrical parts. Due to the larger diameter of the shaft (1½"), the firm claims that this spinner is easier to hold onto and less tiring on the operator. The unit is permanently sealed against dirt and buffing compounds, and smooth working due to its quality ball-bearing shaft mounting. Many types of adapters are easily assembled to this type of spinner, including a solid shank flange which does not unscrew while polishing counter-clockwise.

High Strength Pressure Sensitive Tape

Minnesota Mining and Mfg. Co., Dept. MF, 900 Fauquier St., St. Paul 6, Minn.

What is claimed to be the world's strongest tape with a pressure sensitive adhesive was announced by this firm recently. The new tape has an acetate film backing, and has glass filaments instead of rayon, thousands of parallel filaments that run lengthwise with the tape. The filaments are permanently imbedded in a resilient, shock-proof rubber adhesive on the tape, thus reinforcing the tape.

The new tape provides 500 pounds of tensile strength per inch of width, it is claimed.

Tape No. 890 is designed for "extra heavy duty" packaging, including such jobs as banding hundreds of pounds of steel pipes, tubes and coils for domestic and foreign shipment. It is applied by being hand-wrapped around a load and back on itself. It sticks immediately on contact. For palletizing jobs, the tape is expected to be valuable, due to its minimum stretch under tension (six per cent as compared to 15 per cent for its predecessors).

The new tape is made in 72-yard lengths, and in standard widths of ½, ¾ and 1 inch, with other widths made on special order. Sample rolls are available immediately.

Power Brushing Speeds Bumper Production

The Osborn Manufacturing Co., Dept. MF, 5401 Hamilton Ave., Cleveland, O.

By means of new finishing techniques involving the use of power brushes supplied by the above firm, the Auto-Lite plant at Sharonville, Ohio, has been able to mass-produce automobile bumpers at lower production costs, and materially reduce their number of rejects, it is claimed.

The job done by Osborn brushes is to prepare a smooth surface on the bumpers prior to plating, by blending all grit marks on the cold rolled steel to permit a smooth chrome plate surface. The type of equipment used varies with the bumper section to be polished. A rotary automatic machine is used for the top edge, in-line automatics for the bumper face, and end machines for the curved ends of the bumper. The brushes on these machines will rotate at 2100 revolutions per minute.

The flat steel sheets are pre-polished when they require it, and are then cleaned to remove all oils and abrasive grains. At this point the steel goes to the presses for blanking and forming. Following the forming, the bumpers proceed to the polishing department. The first operation there is the polishing of the bumper edge (see photo). This is done on a nine-head rotary. The first three stations are #150 grit set-up wheels run dry. Then come five #230 grit set-up wheels run greased. Last, an

Osborn Fascut power driven brush run with #180 grit emery.

The next operation is polishing the bumper face. This is done with a 12-head in-line machine. The first five stations are #150 grit set-up wheels run dry. Next, five #220 grit set-up wheels run greased. Last, two Osborn Fascut power-driven brushes run with #180 emery cake. The remaining operation, polishing the bumper's curved ends, is done on eight tandem machines. The bumpers are carried through eight stations of two heads each. The first two stations are #150 grit set-up wheels run dry. Then, four stations of #220 grit set-up wheels run greased. Finally, two stations of Osborn Fascut power-driven brushes run with #180 emery cake. After these operations, the bumper is carried through a cleaning bath prior to copper and nickel plating. Cut and color buffing follows the nickel plating, preparing the surface for the chrome plate.

Simplified Lubrication of Rectifier Units

W. Green Electric Co., Inc., Dept. MF, 130 Cedar St., N. Y. 6, N. Y.

In modern electroplating rectifier units the only regular maintenance required is lubrication of the cooling fans. To perform this operation it is usually necessary to shut down the rectifier unit, and open a door or remove a panel to secure access to the fan motor.

In their new Selectro-Platers, W. Green Electric Co. have simplified this routine operation. Fan motors are fitted with copper tubes leading to standard Alemite grease gun fittings which appear on the front of the cabinet on either side of a neat label specifying how often grease should be applied and what kind of grease to use. Small grease guns, already packed with suitable lubrication, are available from the firm at nominal cost.

An interesting detail is the use of the Alemite "Lubriguard" fittings which positively prevent excessive pressure from reaching the motor bearings and automatically indicate when the grease tube is completely filled.

This new arrangement, which permits the fans to be lubricated through external, convenient, fittings without shutting down the rectifier, should make these units even more popular with the maintenance department.

New Safety Goggle Weighs Less Than One Ounce

Chicago Eye Shield Co., Dept. MF, 2300 Warren Blvd., Chicago 12, Ill.

A new safety goggle extremely light in weight but heavy in eye protection has been announced by the above firm.

The goggle weighs only 97/100 of an ounce, with this negligible weight being distributed evenly over the nose, brow and cheeks. Workers are hardly aware of wearing the new Coverlite, it is claimed.

The new Coverlite is claimed to be exceptionally sturdy. Ample air space and ventilation prevents fogging, while the large frontal area provides a wide range of vision in all directions, it is said. Another feature is the easy-to-adjust elastic headband.

For buffing, polishing, plating, light assembly and spot welding, the new Coverlite is available in clear, light green or dark transparent frames. The new design also permits comfortable wear over most types of personal glasses without interference to the wearer.

Corrosion Resisting Self-Priming Pump

The Duriron Co., Inc., Dept. MF, Dayton 1, Ohio.

The Model 40 Series R Self Priming Durcopump, now in regular production after two years of experiment and plant and field testing, is believed by this firm to be the most efficient centrifugal self-priming pump made for handling corrosive solutions. This new pump is now available in two sizes, one with capacity ranging from 20 GPM against 81 ft. TDH to 160 GPM against 33 ft. TDH and the other with capacity ranging from 40 GPM against 125 ft. TDH to 240 GPM against 75 ft. TDH, when operating at 1750 RPM. Larger pumps are expected to be available later.

The features of this new pump include:

1. Availability in 12 corrosion resisting alloys: Duriron, Durichlor, Durimet 20, Durco D-10, Chlorimet 2, Chlorimet 3, Monel, Pure Nickel, Inconel, Ni-Resist, Nickel Cast Iron and Cast Steel.

2. Conversion of wet end parts from one alloy to another without changing

working dimensions or the power end.

3. Teflon Seal cages in stuffing boxes for lubricant or liquid seal, which cannot score the shaft sleeve.

4. Micro-adjustment of impeller in casing.

5. Renewable shaft sleeves.

6. Corrosion resisting deflectors to protect bearing construction in power end.

7. Elimination of impeller nuts. No threads are exposed to corrosive attack. Impeller heads cannot loosen under normal service.

New Molded Pail for Handling Corrosives

Stokes Molded Products Co., Dept. MF, Trenton 4, N. J.

A new molded pail, utilizing a rubber-base compound and other original features for greater safety and serviceability in the handling of acid and alkaline chemicals, has been developed by the above firm.

Initial and most outstanding feature is the virgin rubber compound, which gives the pail greater resistance to corrosive chemicals, abrasion and heat than conventional compounds, it is claimed. The new Stokes compound will not crack or chip, according to the manufacturer.

Described as light, shock resistant, rigid, and almost chemically inert, the new pail is equipped with a bail-type handle of lead-plated stainless steel with a hard rubber grip. To assure smooth leverage, the bail is mounted in cast lead bearings molded into the bucket to prevent it from pulling out of place.

Other safety features are the pouring lip which reduces drip and the molded tipper on the bottom of the pail which provides a firm hold for accurate control in pouring hazardous contents.

The pail is supplied with graduated markings for measuring one to 12 quarts or one to three gallons.

Further information may be obtained by writing to the firm.

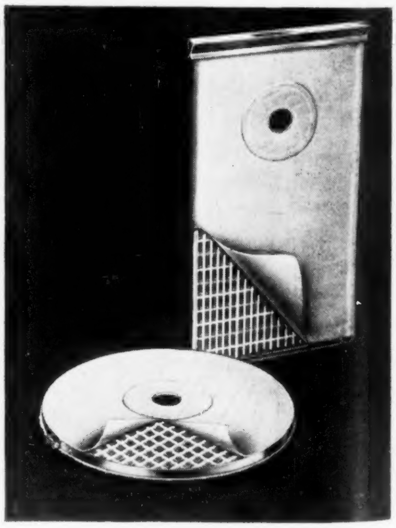
Lucite Filter Plates and Synthetic Filter Cloths

Belke Manufacturing Co., Dept. MF, 947 N. Cicero Ave., Chicago 51, Ill.

Faster changing of filter cloths and more efficient filtering of plating solutions is now possible thru the development of Lucite filter plates and synthetic filter cloths, as announced by the above firm.

In addition to affording faster changing of filter cloths, Belke Lucite filter plates are said to withstand all plating solutions and temperatures, are light in weight and are easy to handle. Channeled in two directions on both sides, the Lucite plates permit free flow of solution that has passed thru the filter cloth.

Round and rectangular Lucite filter plates are made for horizontal and vertical plate filters respectively. The round plates have adjustable bands



around the circumference to hold the filter cloths in place. Changing filter cloths is fast, as the bands can be slipped off and on easily and the need for sewing is eliminated. The rectangular plates slip into a sewed filter bag which is closed by a slide fastener.

The synthetic filter cloths and bags

maintain flow rate much longer than cotton or wool because they have less tendency to clog, it is claimed. Also they are much easier to clean and withstand plating solutions longer, according to the firm.

Belke Lucite filter plates and synthetic filter cloths are available for standard Belke horizontal and vertical plate filters to 200, 300, 500 and 1000 gallon capacities.

Variable Speed Polishing Lathe

Frederic B. Stevens, Inc., Dept. MF, 1800 18th St., Detroit, Mich.

A recent addition to the Stevens line of equipment and supplies for the

metal finishing industry is their Mitchell Variable Speed Polishing Lathe. Outstanding features of this machine are its instantaneous changing of speeds to accommodate various types of polishing or buffing jobs, plus its foot brake and motor cut-out for practically instantaneous stopping of the machine should it be necessary for safety or other reasons. The variable speed is accomplished through the use of a "Roto-Cone" variable speed pulley. Changing of belts or removal of spindles is extremely easy, due to a new method of construction. Models are available in 3-5-7½ H.P., with spindle speeds from 1500-3000 R.P.M. Bulletins describing these machines are available on request.

Portable Ventilators

Mine Safety Appliances Co., Dept. MF, Pittsburgh 8, Pa.

Work in high-temperature and noxious atmospheres is made safer and more comfortable with the new portable ventilators developed by this firm. Equipped with high-velocity fans powered either by gasoline or electricity, the new M.S.A. ventilators provide both ventilating and cooling air, and are so compact and lightweight that they can be wheeled from place to place on the job.

Air is conveyed to the desired point through a 14-inch-diameter, 16-foot-long canvas duct. Ducts are treated for flame and mildew resistance, and when not in use can be collapsed and folded into a compact bundle. A two-way air flow feature permits the duct to be connected to either the inlet or discharge side of the fan, allowing both dust or noxious gases to be drawn from the area, and fresh ventilating and cooling air supplied to the area.

The M.S.A. new portable ventilators are valuable for exhausting gases and vapors, removing fumes from welding operations, and withdrawing dust during sandblasting, cement unloading, plaster chipping, and similar operations.

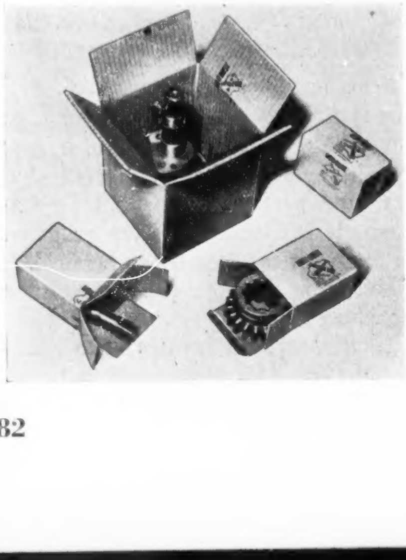
Cartons Impregnated with Nox-Rust Vapor Wrapper

Nox-Rust Chemical Corp., Dept. MF, 2431 S. Halsted St., Chicago 8, Illinois.

Bringing the rust-preventive and time-and-money saving advantages of Nox-Rust Vapor Wrapper to a new field, the above firm announces that they have perfected a method for impregnating chipboard and corrugated cartons with the Nox-Rust chemical.

This new development is ideal for packaging all types of metal parts, tools and appliances. It is claimed to eliminate the need for temporary rust pre-

ventive coatings and inner wrappings previously required to protect the carton from oil or grease staining. An invisible vapor released within the container prevents the formation of rust on metal, according to the firm.



Nox-Rust impregnated cartons round out the protective packaging picture. In conjunction with Nox-Rust Vapor Wrapper paper in rolls and sheets, the carton development makes it possible to give any type of metal product, of any shape or size, protection against rust in an economical manner. The combination meets every packaging problem, it is claimed.

Stainless Steel Drum for Shipping Nickel Brighteners

Udylite Corp., Dept. MF, 1651 E. Grand Blvd., Detroit 11, Mich.

A new stainless steel barrel for the shipment of Nickel Brighteners has just been introduced by the above firm.

According to the Udylite sales staff,

the industry's reception to this new means of transporting Nickel Brighteners in barrels instead of glass carboys has been most enthusiastic. Beside the complete elimination of breakage, there are savings in freight as the tare weigh is much lower when barrels are used. Then, too, storage space is reduced to a minimum, for the stainless steel barrels can be stacked one on top of another which condition is not afforded with carboys. Udylite engineers who have designed the new containers estimate a three to one saving in space requirements.

Several other features include easier and safer handling and a lower freight cost in returning the empty barrels. Barrels come in 15-gallon capacity versus the 12 gallons for a carboy. Pumps fit in easily at the ends of the barrels.

Protective Hand Cream

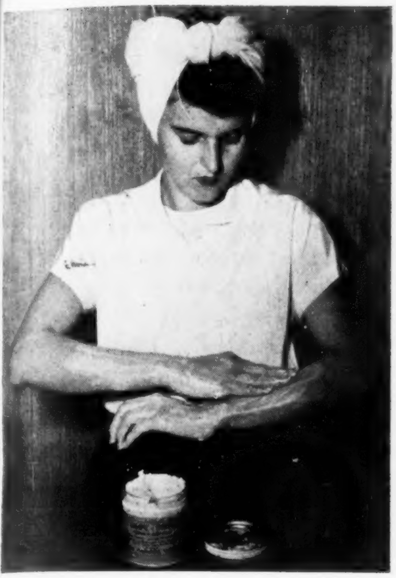
Chase Chemical Co., Dept. MF, 2901 Dover Ave., Cleveland 9, O.

A protective hand and arm cream for shop use, designed to protect skin against paints, printing ink, lacquers, grease, grime, oil, etc., is announced by the above firm. Said to be one of the few protective creams developed without harmful wax fillers, the new hand cream is said to provide many hours of skin protection.

Glov-Cote washes off easily even with cold water. As it dissolves, the protective coating carries with it the paint, grease, ink or grime that gathers during normal working operations.

The manufacturer states that no curative powers are claimed for Glov-Cote, but that instead it serves a preventive purpose.

Glov-Cote is packaged in handy in-



dividual 16-oz. jars for individual employee use. Small sample containers of Glov-Cote are available for trial use and may be obtained by writing directly to the manufacturer.

Clear Strippable Coating

Western Coating Co., Dept. MF, 85 W. Union St., Pasadena 1, Calif.

Westcoat-Clear is a hot metal protective strippable coating that gives protection against rust, corrosion and abrasion. Salt water and salt air have no effect upon parts so treated. Coated parts show no evidence of rust after being subject to 100°F., 100% humidity for 30 days, it is claimed. These coated parts will withstand temperatures ranging from 40° below zero to 160° above. A special rust preventative concentrate gives double protection.

Westcoat-Clear is a high quality protective coating, nearly water white and transparent. Numbers and writing on the part can easily be read through the coating, hence no further labelling is necessary.

To use the material, it is heated in a tank to its molten state—approximately 350°F. The metal part to be coated is dipped into this molten material for about 10 seconds and then allowed to air dry. A strong waterproof, abrasion- and corrosion-resistant film one-tenth of an inch in thickness forms and hardens in less than 60 seconds. This part can then be handled, shipped or stored.

Westcoat-Clear can be remelted and used over and over again, as long as it is not contaminated by a foreign substance.

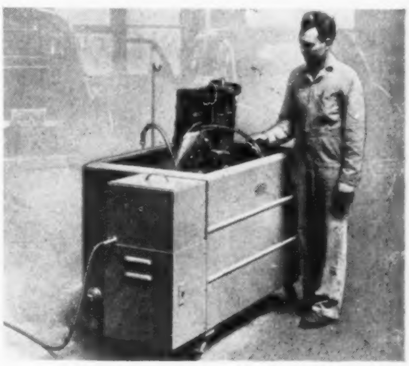
Western also has dyes that give deep rich colors without disturbing transparency. The melt compound is furnished in clear form together with separate color dyes. Pour the dye into as little compound as the job at hand requires. In that way you get the color you want. If you have an identification problem, different colored coatings mean instant identification.

Parts Cleaning Machine

Wilkinson Mfg. Co., Dept. MF, Omaha Nat'l Bank Bldg., Omaha, Neb.

A new machine for cleaning all kinds of mechanical parts is the Wilkinson Degreaser, just placed on the market by this firm.

The unit offers an efficient means for cleaning parts, the manufacturer claims; cleansing action is accomplished by flooding the parts with chemical detergents which wash the metal free of any accumulation of dirt, grease and grime.



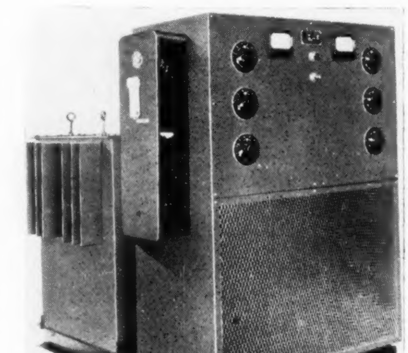
The unit is portable, being equipped with casters so that it may easily be moved about the shop as needed.

The design of the Wilkinson degreaser provides for installation of an immersion-type heating unit with thermostatic control. The heater is supplied by the manufacturerer as an optional extra and may easily be installed at any time.

Selenium Rectifiers

Clark Electronic Laboratories, Dept. MF, Palm Springs, Calif.

This firm is now supplying complete and compact selenium rectifiers for all industrial uses, including oil, air, and water cooled types. Sizes from 1000-50,000 amperes are included in their line, and the units are complete with switches, controls, and instruments conveniently mounted in neat, compact cabinets. Oil and water immersed



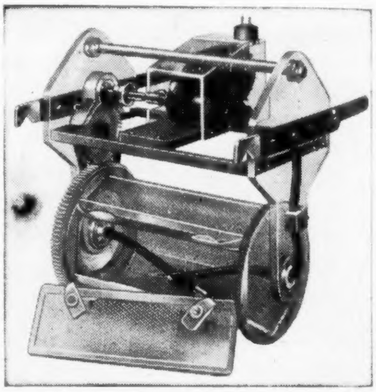
rectifier stacks may be easily lifted out of the cooling tank for routine inspection, and all connections are readily accessible. Voltage range of this line of equipment is from 6-275, with up to 100 KW of available power per unit. Several units can be combined for larger power requirements. Complete details may be obtained by writing to the above address.

Portable Small-Lot Plating Barrel

Belke Mfg. Co., Dept. MF, 941-51 N. Cicero Ave., Chicago 51, Ill.

New ease, speed and convenience in plating small odd lots are afforded by small portable plating barrels for use in still plating tanks or special tanks.

Called Porto-Platers, the units are



excellent for plating jewelry, odd lot production, laboratory work, test runs and similar work. Made of high temperature Lucite, they withstand all cleaning cycles and gold, silver, rhodium, cadmium, copper, nickel, zinc, tin and brass plating cycles at temperatures to 185°F., it is claimed. A self contained motor drive with plug connection makes the unit easy to transfer.

When used in still plating tanks, the support arms of the unit rest across the bus rods permitting the cylinder to hang down into the solution. The contact ends of the support arms are notched for the cathode rod to assure electrical contact and to hold the unit in position. Porto-Platers may also be used in special small tanks.

The cylinder, cover, cover locks, hangers, gears and bushings on Porto-Platers are all of high temperature Lucite. The one piece, molded cylinder shell is bonded into grooved cylinder ends. There are no ribs, rods or crevices to trap small pieces. A clutch disengages the cylinder for fast loading and unloading. Time often wasted when cylinder is positioned by

starting and stopping motor is saved. The screw-on ball contacts are easily removable for stripping. Cover locks are attached so they cannot be misplaced or dropped into tank, it is claimed.

Porto-Platers are available in three sizes with capacities of 1/4, 1/2, or 3/4 peck. Complete information and dimensions furnished promptly on request to the manufacturer.

Business Items

Electric Products Co. Appoints Houston Representative

The Electric Products Company has appointed the *William E. Brice Co.*, Houston, Texas, as District Representatives for Southern Texas.

William E. Brice, who is a native

William E. Brice

of Texas, is a graduate electrical engineer from Rice Institute. In addition to his industrial experience with the General Electric Company, Houston Lighting and Power Company and the Wilson Electric Equipment Company, he is acquainted with the oil field and refinery operations.

The William E. Brice Company will handle The Electric Products Company line of Battery Chargers, Electrolytic Equipment, Synchronous and Induction Motors, Frequency Changers, A-C and D-C Generators and Industrial Dynamometers.

This appointment is another step by The Electric Products Company to establish and develop strategically located representatives for a nationwide service and selling organization.

H. D. Fowler Co. to Represent Electro Chemical Co. in Pacific Northwest

The Electro Chemical Supply & Engineering Co., 750 Broad Street, Emmaus, Pa., announces the appointment of the *H. D. Fowler Co., Inc.*, of Seattle, Wash., as agent in the Northwest.

Mr. H. D. Fowler, the head of this Company, has had long experience in waterworks and industrial supplies and equipment, including acid and alkali-proof construction work. He has also handled jointing materials for water pipes for many years. The materials which the H. D. Fowler Co., Inc., will handle for Electro Chemical, include Wedgetite jointing material for water pipes, Brimsto sulphur cement, Lecite resin cement, and Duro Triplex silicate cement for acid and alkali installations; also Duro-Prene and Duro-Bond synthetic rubber and natural rubber coatings and linings.

Terwell New Rolock Engineer in Chicago

Rolock, Inc., Fairfield, Conn., fabricators of heat and corrosion alloys, announces the appointment of *Elmer A. Terwell* as their Sales Engineer in the Chicago territory.

Mr. Terwell has had wide experience in the high alloy field with the Driver-Harris Co., The Salkover Metal Processing Co. (of Illinois), and he has served as Secretary-Treasurer of the Chicago Chapter of American Society

for Metals. His headquarters will be at 3382 *Avondale Ave., Chicago 18, Illinois.*

American Wheelabrator Appoints J. R. Bunch

J. Robert Bunch has been appointed sales representative to assist J. D. Alexander in the Cleveland sales office of *American Wheelabrator and Equipment Corp., Mishawaka, Ind.*

He received his formal education at Indiana University, and joined this company in 1936. After spending nine years in various production departments, he has, for the past four years, supervised the erection and servicing of Wheelabrator blast cleaning equipment and Dustube collectors in the Cleveland area.

McAleer Co. Ltd. Purchases New Building

Theodore F. Onkey, President of *The McAleer Mfg. Co., Ltd.*, of *Canada* announces the purchase of a three story building with railroad siding at New Toronto, Ontario. The building comprises 12,000 sq. ft. with additional smaller buildings for the storage of raw materials. After receiving new equipment and the modernization of the offices, laboratory, etc., this property will house their company which will be moved from their present quarters at Chatham, Ontario.

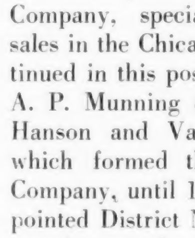
Mr. Harry Kirkham will be Office Manager, and the operations will be supervised by *Mr. Alex C. Clark*, Treasurer of the corporation.

Changes in H-VW-M Sales Organization

John A. Bauer, Vice President and Sales Manager of The *Hanson-Van Winkle-Munning Co., Matawan, N. J.*, announces the following changes in the sales department.

P. R. Lyons

P. R. Lyons, previously District Manager of Ohio, becomes Manager of Electrical Sales with headquarters in Matawan, coordinating activities in connection with the sale of motor generator sets, rectifiers, tank rheostats, and other electrical products. Ross Lyons, as he is generally known, attended the Armour Institute in Chicago after which he engaged in electrical work for the Illinois Steel Company. He served in the Army in World War I as a member of the Engineer Corps, also engaging in electrical work, and after the War, returned to the Illinois Steel Company. He left the steel industry to go into job plating. In 1925 he joined A. P. Munning & Company, specializing in conveyor sales in the Chicago territory. He continued in this post after the merger of A. P. Munning & Company with the Hanson and Van Winkle Company, which formed the present H-VW-M Company, until 1931 when he was appointed District Manager for Ohio. It was this post from which he was transferred to become Manager of Electrical Sales, with headquarters in Matawan, New Jersey.



Martvig J. Moll

Martvig J. Moll has been appointed Manager of Conveyor Sales. He obtained his engineering education at Columbia University and broke into industry with A. Schrader's Sons, Inc., Brooklyn, serving in various capacities, finally as Purchasing Agent. Later, after four years of sales work in the Far East for the Texas Company, he joined H-VW-M in April, 1923 to work on the Munning Full Automatic Conveyor which was promoted in that year. One of the pioneers in this field, Mr. Moll has continued active in it throughout the years and has achieved a high place in advancing the full automatic plating machine.

Irving A. Gemmell has been designated as Assistant Manager of Conveyor Sales. Mr. Gemmell joined the A. P. Munning Co. after his graduation from Pratt Institute in Chemical Engineering, as a student engineer. After the merger of the company with the Hanson-Van Winkle Company to form the present H-VW-M Co., he was assigned to work as an engineer in the automatic and semi-automatic conveyor department, and later went out into the field in Metropolitan New York as a Sales Engineer. At the outbreak of World War II, Mr. Gemmell was recalled to the home office in Matawan to work on special equipment projects involved in the war effort. Since the conclusion of this work, he has concentrated on automatic equipment sales, and in his new post will continue to work in this field.

Irving A. Gemmell

Wilfred G. Cryderman, covering the Southern Ohio Territory, has been transferred to the Cleveland office. He is a graduate of Michigan State College with a B.S. Degree in Mechanical Engineering. He first joined the Westinghouse Electric Corporation (then Westinghouse Electric and Manufacturing Co.) as a Student Engineer and after training, was transferred to their District Sales Office in Cleveland where he remained until 1946. In May 1946 he joined the Hanson-Van Winkle-Munning Co. as Dayton Sales Representative and served in that capacity until transferred to his new post in Cleveland.

Wilfred G. Cryderman

Gordon Lyons has been appointed Sales Representative in Dayton, Ohio. He is a graduate of Case Institute of Technology in Mechanical Engineering, 1949. He joined the Army in July, 1943, becoming a Second Lieutenant and navigator of a B-17. Mr. Lyons completed 34 missions over Germany and ended his Army career by navigating his ship back over the Atlantic Ocean to America. He was discharged November 20, 1945. Following his graduation from Case, Mr. Lyons joined the H-VW-M Company and took a three months training course in Matawan. He will now work in General Sales with headquarters in Dayton, Ohio.

Gordon R. Lyons

Electro Chemical Moves to New Quarters

The *Electro Chemical Supply & Engineering Company* announces the removal of its offices from Paoli, Pa., to its new office and plant at 750 *Broad Street, Emmaus, Pa.*

Metallics, Inc. Occupies New Plant

Metallics, Inc., manufacturers of name plates and decorated metal products, announce that they have moved from LaCrosse, Wis. to Onalaska, which adjoins LaCrosse.

Federated Metals Names Manager of New Plating Department

The appointment of *Sherman M. Goble* as Manager of its new Plating and Electrochemical Department was made today by Federated Metals Division, American Smelting and Refining Company.

Federated's activities in the plating industry were expanded recently with the acquisition of the anode facilities formerly owned by the Metallurgical Products Company of Philadelphia. Increased production of copper, tin, lead and zinc anodes has resulted. The new department, under Mr. Goble, has been organized to facilitate sales and service.

Mr. Goble brings to Federated many

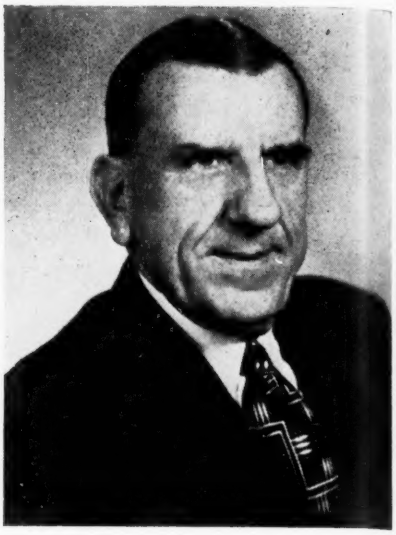
Sherman M. Goble

years of experience in the plating field. Before joining Federated he was with the Seymour Manufacturing Co., Seymour, Conn.; the McGean Chemical Co., Cleveland; and most recently with the Lea Manufacturing Co. of Waterbury, Conn. His headquarters will be at 120 Broadway, New York.

Charles E. Crowley Named President of Alsop

Charles E. Crowley was elected president of the Alsop Engineering Corp. of Milldale, Conn., on Tuesday October 11, 1949 at a special meeting of the directors. He succeeds the late Samuel Alsop, Sr., as head of the concern. Mr. Crowley has been associated with the concern for 27 years.

The other officers of the company are *Samuel Alsop, Jr.*, first vice president; *W. W. Freystedt*, of New York City, second vice president; *James J. O'Shea*, third vice president; *E. Z. Ross*, secretary and treasurer, and *C. Clark Morganson*, assistant secretary.



Chas. E. Crowley

The Alsop Engineering Corp. moved to Milldale, Conn., in 1936 and is engaged in the manufacture of liquid-processing equipment including filters, mixers, agitators, pumps and stainless steel tanks.

J. H. Overpeck Co. New Azed Distributor

Azed, Inc., 851 *S. Market St., Waukegan, Ill.*, has recently appointed *J. H. Overpeck Co.*, 1112 *House Bldg., Pittsburgh*, to distribute its line of detergents and accelerators for pickling baths, addition agents for galvanizing and zinc electroplating baths, and secondary treatments for zinc surfaces. The territory covered by the Overpeck organization will include western Pennsylvania, eastern Ohio and part of northern West Virginia.

Hampel New Supervisor at Armour

Clifford A. Hampel has been named supervisor of extraction metallurgy at Armour Research Foundation of Illinois Institute of Technology. Hampel formerly headed the inorganic technology program of the ceramics and minerals department. Hampel, a chemical engineer, will supervise the Foundation's extensive research program on the recovery of metals from their ores.

Hampel joined the Foundation staff

Clifford A. Hampel

in 1946 as a chemical engineer. He was named supervisor of inorganic technology in 1948.

Hampel was general chairman of the annual meeting of the Electrochemical Society held October 12-15 in Chicago. He is an officer and member of numerous other technical societies and fraternities.

Study Course in Air Pollution

The University of Michigan School of Public Health will offer a training course in Air Pollution on February 6, 7 and 8, 1950 at Ann Arbor, Mich.

This is the first course in Air Pollution given by the School of Public Health. It is given at the suggestion of workers in the field of study of these problems, who have suggested the desirability of an orderly review of the problem in the light of present knowledge.

While necessarily somewhat technical in character, the course is intended to serve personnel of a wide variety of interests, such as air pollution control and other public officials, industrial chemists, engineers and management, health officers and physicians of industrial communities, industrial hygiene peronnel who render service in this field, and sanitary engineers, especially those concerned with the disposal of industrial wastes.

The Planning Committee anticipates that the more broad and fundamental treatment of subjects provided for in this course may be followed by more intensive treatment of certain selected subjects at a later date.

Chemical Corp. Completes New Laboratory

A new laboratory complete with the most modern equipment for research and testing in the metal finishing field has recently been added by *The Chemical Corp., 54 Waltham Ave., Springfield, Mass.* The company manufacturers Lusteron Zinc Bright Dip and several other metal finishing specialty products and distributes a full line of platers equipment and supplies, including Pennsalt Cleaners exclusively in New England.

K. P. Bellinger, vice president in charge of metal finishing, says that development work now being carried on in the new lab is expected to result in the early announcement of several new products.

John Kosmos

Mr. John Kosmos, a member of the Electrochemical Society and the AES, has joined its staff as Technical Service Man, heading its new laboratory and available for consultation on the metal finishing problems of its customers.

Kosmos has been a resident of New England since 1940 and has been actively engaged in material control, process control, metallurgy and metallography with such companies as Pratt & Whitney and Underwood. His educational background includes studies at School of Technology at City College, New York, Connecticut School of Engineering and a degree in Engineering from Trinity College.

Much of Kosmos' recent work has been in connection with Lusteron, zinc bright dip made by The Chemical Corporation.

Ohio Dept. of Health to Study Plating Waste Toxicity

A provisional allotment of $12,900 has been established for the Ohio Department of Health for the study of the toxicity of wastes from electroplating plants by the Federal Security Agency, Public Health Service, under authorization of Public Law 845 (Water Pollution Control Act). Final grants are subject to the approval of the Surgeon General after examination of the application.

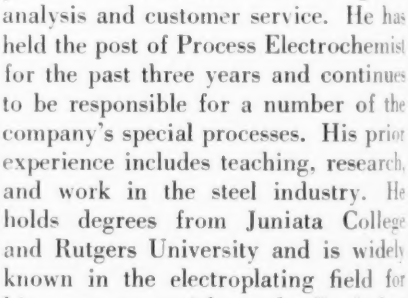
A total of $891,487 has been granted to date (Nov. 30) to various state and interstate agencies for studies of water pollution under terms of the Act. Forty-five states have applied for and been granted funds for this work to date, emphasizing the intensive study being given to this important problem. It is also reported that preliminary comprehensive reports, containing data on stream pollution conditions existing throughout the country, are being developed by Public Health Service engineers from information being furnished by over 35 States, in accordance with the provisions of the Act.

These data eventually will be incorporated into documents officially known as comprehensive reports. When completed, the reports will provide exhaustive inventories of factors contributing to and conditions created by polluted waters. They will then serve as the basis for comprehensive programs of water pollution control designed to combat conditions which are threatening the quality of the nation's water resources.

Hanson-Van Winkle-Munning Co. Advances Chemists

The Hanson-Van Winkle-Munning Co., Matawan, N. J., announces the advancement of two members of its laboratory staff, *Dr. D. Gardner Foulke* and *Thomas J. Menzel.*

Dr. D. Gardner Foulke has been appointed Chief Chemist in charge of analysis and customer service. He has held the post of Process Electrochemist for the past three years and continues to be responsible for a number of the company's special processes. His prior experience includes teaching, research, and work in the steel industry. He holds degrees from Juniata College and Rutgers University and is widely known in the electroplating field for his numerous articles and talks before



Dr. D. Gardner Foulke

Thomas J. Menzel

the American Electroplaters' Society and others. He was awarded the American Electroplaters' Society Gold Medal in 1945 and is currently chairman of the Research Directing Sub-Committee for A. E. S. Project No. 2. He is a member of several technical and scientific societies.

Thomas J. Menzel has been advanced to the position of Plating Chemist. For the past several years he has been in charge of analytical work and customers' service work. In his new position he will be responsible for all experimental and process plating in H-VW-M's new plating laboratory. Mr. Menzel holds the degree of B.S. from Hudson College of St. Peters College, Jersey City, N. J., and has also attended New York University. His work in the electrochemical field began when he joined the Hanson-Van Winkle-Munning Company in 1943, as a chemist, later becoming analytical chemist, from which he has been promoted to his new post. He is a member of the American Electroplaters' Society.

Platecoil Adds Representatives in Midwest

Four new representatives have been added in the Midwest by the *Platecoil Div.* of the *Kold-Hold Mfg. Co.*, Lansing, Mich. These new representatives make possible better service in helping manufacturers work out their industrial heating problems.

The new representatives are as follows: The *Henry P. Thompson Co.*, Cincinnati; *Power Plant Efficiency Co.*, Indianapolis; *Patton Equipment Co.*, St. Louis; and *W. P. Nevins Co.*, Chicago.

Baker New Engineering Director at Electro Chemical

The Electro Chemical Supply & Engineering Co., 750 Broad Street, Emmaus, Pa., announces the appointment of *Fred G. Baker* as Director of Engineering & Design. Mr. Baker is a chemical engineer, graduate of the Iowa State College, 1940, and until recently, a member of the Engineering Department of the E. I. du Pont de Nemours & Co., Inc., Wilmington, Delaware.

Electric Products Co. to Enter Selenium Rectifier Field

The Electric Products Co., one of the leading manufacturers of motor-generator equipment for the electroplating industry for many years, has announced recently their entry into the selenium rectifier manufacturing field. Their line of plating rectifiers will use the selenium stacks manufactured for many years by the *Federal Telephone and Radio Corp.*, one of the pioneer firms in the selenium rectifier field. Being able to offer both types of DC power equipment will enable the Electric Products Co. to recommend the most efficient type of equipment for any application, the firm feels.

Holley Leaves Whyco Chromium Co.

Mr. John S. Holley, formerly Director and Vice-Pres. of Whyco Chromium Co., of Waterbury, Conn., has left that organization and is now in business for himself marketing a bulk

chromium plating process for plating small parts not suitable for regular plating procedures. Previous to his association with Whyco, Mr. Holley served as technical representative of the Apothecaries Hall Co.

NEW BOOKS

Principles of Electroplating and Electroforming

By Wm. Blum and Geo. B. Hogaboom. Finishing Publications, 11 *W.* 42 *St., N. Y.* 18, *N. Y. Price* $6.00.

The third revision of this standard text for the electroplating science has long been awaited by the industry. The wait has been justified, for in the new volume the eminent authors have revised and brought up to date a large amount of material, in keeping with the rapid strides made in the technology of the industry since the first edition was published. It would be superfluous to remark on the value of a book which has been so well read and consulted over the past 25 years, therefore this review will confine itself to pointing out the most important revisions and additions in the new volume.

In the theoretical section, much more attention has been devoted to the subjects of polarization, cathode films, and throwing power, all of which are of vital importance to an understanding of modern high-speed bright plating. The selection and evaluation of deposits is discussed at some length, and the incorporation of the bath analytical methods into a single section is an improvement over the former separation of the material. Reflecting the technological advances made in the industry since the publication of the first edition is the section devoted to special linings for tanks, and the section on power supplies, which includes a lengthy discussion of rectifiers and types of plating current (interrupted D.C., periodic reverse, superposed A.C., etc.).

The most significant revisions will be found in the chapters devoted to the plating baths proper, where space is allotted to the many new plating formulae developed during the past twenty years. These include fluoborate copper, alkane sulfonate copper, pyrophosphate copper, amine copper, various bright nickels, and much new material on alloy plating and deposition of such metals as molybdenum, tungsten, manganese, etc. A unique feature of this new edition is the grouping of the various metallic plating baths according to the periodic arrangement of the deposited metals.

Anyone who has ever had to refer to the older edition, and it would be hard to find a plater or electrochemist who hasn't, will certainly want a copy of this new edition.

W. A. R.

Determination of Impurities in Electroplating Solutions

By Serfass, Levine, Prang, Oyler, Davis, and Perry. AES Research Report No. 6. *Available from American Electroplaters Society, P. O. Box* 168, *Jenkintown, Pa. Price* $1.25 *per copy.*

This report covers methods for determining the following impurities in nickel plating baths; silica, sodium, potassium, cadmium, aluminum, ammonium, chromium, zinc, and calcium. Both routine and accurate methods are given, and in most cases the methods involve colorimetric determination as a final step.

The Principles of Electrodeposition

By Samuel Field. Published by the Pitman Publishing Co., 2 *W.* 45*th St., New York, N. Y. Price* $6.00. 340 *pages.*

This is the second edition of this book which forms a companion text to the treatise on the practical side of elec-

trodeposition by Field and Weill. In this volume the author covers the theoretical aspects of the subject, and discusses such subjects as Qualitative and Quantitative Electrolysis, Properties of Gases, Properties of Solutions, Conductance of Electrolytes, Transport Numbers, Thermo-Chemistry, Electrode Potentials, Hydrogen Ions, Throwing Power, Co-Deposition of Metals, Bi-Polar Electrodes, Addition Agents, etc. The author's close association with the practical side of electrodeposition (as President of the Electrodepositors Technical Society) enables him to tie in the theoretical treatment of this subject with the practical aspects in a manner which will be appreciated by operating electroplater and electrochemist. The book is not intended for the man without previous chemical or physics training, although a comprehensive knowledge of either subject is not a prerequisite to an understanding of the subject matter of this text.

W. A. R.

News from California

Shepard & Kent New West Coast Distributors for MacDermid, Inc.

MacDermid Incorporated, of *Waterbury, Conn.*, recently announced that they have appointed *Shephard & Kent, Inc.*, 3132 *East Washington Blvd., Los Angeles* 23, *Cal.*, as West Coast distributors for their line of metal finishing products — Anodex, Dyclene, Metalex, Rocheltex, MacDermid Bright Copper, and other metal finishing aids. These materials are all stocked at the above address for immediate shipment. Their former West Coast technical sales representative, *Mr. G. Stuart Krentel*, became associated with Shepard & Kent on December 1, and will continue to service former MacDermid Incorporated customers as well as assuming his new responsibilities.

L. R. Nerrell has been appointed advertising manager for the *Amercoat Division, American Pipe & Construction Co., South Gate, Calif.* His headquarters are in the new building recently completed for the Amercoat Division at 4809 *Firestone Boulevard.* Nerrell was formerly assistant to the director of sales and advertising of the National Electrical Products Co., Pittsburgh, Pa.

Emmett Holman, chief chemist of Turco Products, Inc., *Paul Pariseau* of Pacific Chemical Co., and *Keith Whitmore* of C-B Chemical Co., Los Angeles, on the night of December 4 conducted a program entitled "*Detergents in Action*" on the Science Page of the Week period sponsored by the American Chemical Society over television station KTLA, Los Angeles.

The program was designed as a visual and oral demonstration of the work played by detergents in the field of general industrial chemistry. The 15 minute program consisted of a short talk by Mr. Holman on water softening and detergents; comment by Mr. Whitmore on the protective action of detergents, safety factors and corrosion of metals; and various laboratory demonstrations by Mr. Pariseau, including the one in which, through the application of wetting agents, a duck apparently is made to sink in water.

The first televised electro-plating demonstration will be presented over Station KTLA at 9:30 p.m. January 8, 1950, with members of Los Angeles Branch of the AES providing the cast. Representing the AES on the program are *Herold Kroesche, Emmett Holman*, and *Leon Kadison.* This television program is planned to present to the layman a demonstration of the importance and significance of plating in everyday life. Mr. Kroesche is cast as the commentator to explain how plating effects nearly every human being. Mr. Holman is scheduled to explain and demonstrate how metal is cleaned prior to plating, and Mr.

Kadison will give the actual plating demonstration in glass tanks which will enable the television audience to see what takes place in the tank when the part is immersed in the solution.

H. C. Pierce, formerly owner of the Hard Chrome Engineering Co., Los Angeles, and *A. W. Habitz*, formerly associated with the Detroit Plating Works, have established the Sunset Plating Company, with plant and offices at 432 N. Varney St., Burbank, Calif.

The new shop is housed in a 50 x 60 foot building and equipped with facilities for specializing in gray anodizing, cadmium and hard chrome plating, mainly on aircraft parts. New tank facilities recently installed include eight-foot, 650-gallon units for anodizing, cadmium and hard chrome.

The home of *Mr.* and *Mrs. Clarence Thornton* (he's Pacific Coast manager for Chas. F. L'Hommedieu & Sons Co.) in Van Nuys, Calif., was the scene of a gay pre-Christmas party attended by a number of members of Los Angeles Branch, A.E.S. Present were Mr. and Mrs. Marcus Ryncofs, Mr. and Mrs. E. W. Francis, E. R. Wiliams and daughter, Miss Mildred Williams, Mr. and Mrs. Earl Coffin, and Mr. and Mrs. Ray Vasquez. Contract bridge, followed by a baked ham dinner was the schedule of events, and it is a safe bet that more "plating" than "Culbertson" was talked about during the bridge game.

Spebra Products Mfg. Co., formerly located in Brooklyn, N. Y., has moved factory and administrative offices to a new building at 2017 Granville Ave., West Los Angeles, Calif., *G. B. Smigel*, president, reports. The plant is equipped for the production of hot plastic tank applications for application on steel, wood and concerte. The firm's products find use in the metal finishing field as well as in such industries as the distillery and winery fields in which large vats and tanks are used.

Industrial Electronics & Transformer Co. moved December 1 into enlarged quarters at 8655 South Main St., Los Angeles, where, President *Allen Rosenstein* reports, 8,000 square feet of floor area are available for the manufacturing operations attendent upon the production of plating machines, rectifiers and transformers for the electroplating industry, and airplane landing equipment. The new plant provides quadruple the floor area of the former factory at 1801 E. Slauson Ave. *Keith Holzclaw* is sales manager, *Harold Hudson* advertising manager, and *Alvin A. Amster*, superintendent.

Los Angeles Buff Co. is now located at 8126 So. Central Ave., Los Angeles. Repair of buffing wheels is one of the new specialty services this firm is offering.

Western Brass Works has construction underway on a 20,000 square foot plant addition at 1441 Naud Street, Los Angeles, to provide increased facilities for the production of brass and bronze castings.

A recently organized new firm in Los Angeles is the *Duncan-Rhone Co.*, with plant at 8619 West Third St. The company deals in precision castings of non-ferrous metals.

William D. Briggs has been appointed process engineer in the Turco Products Company's technical division.

Manufacturers' Literature

Corrosion Resistant Cement Chart

Special Chemicals Dept., Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, Pa.

A new, complete chart showing the resistance of both resin and silicate cements to various corrosive chemicals has just been issued by the above firm.

Designed as a tool to aid the corrosion resistant masonry construction trade in selecting the proper cement for specific industrial uses, the chart shows the resistance of Pennsalt PRF, Asplit, Causplit, Pennsalt HF, and Penchlor Acid Proof Cement to a list of 259 chemicals and chemical compounds from acetaldehyde to zinc sulfate.

The new chart is believed to be one of the most complete listings of its kind and is based on reliable tests conducted by Pennsalt. Copies may be obtained by writing.

Electric Heater Catalog

Edwin L. Wiegand Co., Dept. MF, 7500 Thomas Blvd., Pittsburgh 8, Pa.

An almost endless variety of standard electric heating units, many of them entirely new, are listed in the new Chromalox Catalog of Industrial Electric Heaters just published.

Four basic Chromalox units—strips, rings, tubulars, and cartridges—with wide variations in wattage, voltage and sheath material, are listed, as well as easy selection and application data.

In addition there is shown complete assembled heating equipment, for example:

The Chromalox all-metal Radiant Heater and variable control equipment.

Blower- and convection-type heaters ranging from 250 watts to 40 Kw.

Large circulation heaters rated up to 100 Kw. for heating water, oil, heat transfer mediums such as Dowtherm, Arochlor, etc.

A complete line of immersion heaters with forged steel and standard pipe flanges, ranging from 1 to 50 Kw. for oil and 100 Kw. for water, for use at high operating pressures and temperatures.

A new line of 2" screw plug immersion heaters, all of which are either Inconel or stainless steel throughout.

A number of units made especially for converting urns, percolators, standard hot water tanks and other vessels to electric heat.

A new line of portable immersion heaters for use in drums and tanks.

In general, the catalog incorporates new industrial heater developments to meet increasing demands for electric heat, as well as additions to standard equipment listed in previous catalogs.

Industrial Safety Catalog

Willson Products, Inc., Dept. MF, Reading, Pa.

This firm has just issued their new industrial safety equipment catalog. In addition to providing product information on the company's line of eye and respiratory equipment, this 64-page book contains a fund of technical and reference material. This has been included to help the user select the proper type and style of equipment for the specific occupational hazard involved, and to give him information on its use and care.

Charts throughout the catalog show at a glance the comparative features of various styles and aid in the selection of the most comfortable style for the user. The book is profusely illustrated.

Individual Dust Collectors

Dorden and Co., Dept. MF, 526 W. Jefferson Ave., Detroit, Mich.

This firm has issued a bulletin describing their line of unit-type dust

collectors for the metal finishing trade, which includes water absorption types, filter bag types, and glass fiber filter types. Sizes, ratings and prices are also given. Copies available on request.

New Basket Bulletin

Cleveland Wire Cloth & Mfg. Co., Dept. MF, 3573 E. 78th St., Cleveland 5, O.

This firm has just published a new two-color folder describing the use and application of industrial wire baskets. This Bulletin No. 8 illustrates the most commonly used basket styles, the types of metals used, and all data necessary for ordering baskets for specific industrial basket applications. Copies of the Bulletin are available on request.

Graphite Combustion Chambers and Impervious Graphite Burner Nozzles

National Carbon Co., Inc., Dept. MF, 30 East 42nd St., New York 17, N. Y.

A booklet describing and illustrating equipment for the production of hydrogen chloride gas by burning hydrogen and chlorine has been issued by this firm.

The booklet describes the graphite combustion chamber and the impervious graphite burner nozzle, outlines the operation of the complete system, and points out the principle features of superiority, such as long life, absence of corrosion, minimum maintenance, the ability to withstand thermal shock, the simplicity of the system and the moderate installed first cost. Capacities of the combustion chambers and sizes of the burner nozzles are listed in a convenient table, followed by assembly drawings of the equipment.

A copy of Catalog Section M-9602, *"National" Graphite Combustion Chambers and "Karbate" Burner Nozzles*, may be obtained by writing to the above address.

New Instrument and Control Valve Catalog

Fischer & Porter Co., Dept. MF, 50 County Line Rd., Hatboro, Pa.

A wide variety of primary and secondary flow instruments and control valves, for all industries, is described in a completely new 24-page illustrated catalog now available from the above firm.

Illustrated and described are variable-area primary flow meters . . . frictionless, series-resonant circuit electrical transmitters . . . "Rato-matic" flow rate recorders, controllers, and ratio controllers . . . "Rato-Count" totalizers . . . "Accuro-Batch" control systems . . . and "Magna-Bond" Flowrator direct-connected recorders, controllers and pneumatic transmitters.

Also covered in this catalog is the new and improved "Pneumatrol" air-operated control mechanism, and the company's line of "Valvrator" air-operated, diaphragm motor valves.

Copies of Catalog 50 can be obtained by writing to the above address.

Letters to the Editor

Dear Editor:

I read with interest the article in your July issue on the old problem of carbonate removal from and control in cyanide solutions.

The subject is one in which I have been interested for years as a practical plater and I have investigated almost every possible angle.

The use of Barium Cyanide (which Mr. Ross did not discuss) is about the most practical, because in a Sodium Cyanide solution the carbonate would be precipated out as an insoluble barium salt, while a corresponding amount of Cyanogen would be released in the solution to combine with the liberated Sodium as Sodium Cyanide. This very fact, however, limits its use to merely that of control of the existing carbonate content. If any attempt was made to remove total carbonates, this would result in the release of an undesirable amount of free cyanide.

The objections to the use of gypsum as discussed in the article are identical to that of the use of Calcium Chloride; i.e., its use results in the introduction of salts which would induce corrosion of the steel or iron tank, while I would personally be unwilling to introduce any large quantity of chlorides or sulphates into any of my cyanide plating solutions.

In a tropical country, we can rule out the total freezing method or partial freezing with dry ice, but even if this were practical in a hot climate such as ours, carbonates are not capable of practical freezing out below a concentration of say 10 oz. per gal., and that is still an undesirable amount.

I come now to Mr. Ross' novel suggestion regarding the use of Calcium Carbide and observe that in the last paragraph of the article he states:—

"In a period of time, if so desired, all of the Sodium Carbonate can be removed as precipated Calcium Carbonate."

Frankly, I do not see how this could be accomplished, unless you are going to introduce and maintain, in the plating solution, an equivalent amount of Sodium or Potassium Hyroxide (depending upon the original cyanide used). Such excess of hydroxide would not only be objectionable in the operation of the plating solution, but its presence in such large quantities would increase the rate of absorption of CO_2 with the resulting formation of soluble carbonates, so that the last state would be decidedly worse than the first. This method, then, could do no more than control the carbonate content within the limits laid down by the permissible amount of hydroxide released.

I shall be glad of Mr. Ross' comments and otherwise congratulate him on an admirable discussion of what I consider is possibly the only remaining problem to be solved in the art of Electro-deposition as practised today.

Very truly yours,

HARRY E. VENDRYES, Prop.

P. C. Vendryes & Son

Kingston, Jamaica, B.W.I.

Reply to Mr. Vendryes' Letter

Mr. Walter A. Raymond
Engineering Editor
Finishing Publications, Inc.
11 West 42nd Street
New York 18, N. Y.

Dear Editor:

In response to Mr. Vendryes' letter of October 18, 1949, commenting on my article in the July, 1949, issue of Metal Finishing, I agree that the use of barium cyanide (or calcium cyanide) is one of the best *theoretical* methods of removing and controlling carbonates in cyanide plating solutions. Since the available commercial grades of barium cyanide (or calcium cyanide) are fused mixtures of barium cyanide (45 per cent—50 per cent)

and barium oxide [or calcium cyanide (45 per cent—50 per cent) and calcium oxide], one would actually be adding cyanide and hydroxide to the bath. To control the cyanide bath perfectly, it would be necessary to replace the sodium cyanide and sodium hydroxide in the exact amounts in which they were consumed in forming sodium carbonate. Barium cyanide (with about 50 per cent barium oxide would keep the bath in balance only when the bath was operated in such a manner that one half of the carbonate was formed from sodium cyanide and one-half from sodium hydroxide. The addition of sodium cyanide or sodium hydroxide increases the total sodium ion concentration and aggravates matters. However, drag-out of plating solution helps to reduce the sodium ion concentration.

In practice, the use of barium cyanide or calcium cyanide is very dangerous because moisture decomposes them to liberate deadly hydrocyanic acid fumes. Calcium compounds are less expensive than barium salts, and calcium cyanide is three times more reactive by weight than barium cyanide. Calcium carbonate and barium carbonate have nearly identical solubility product constants of 4.8 by 10^{-9} and 4.9 by 10^{-9}, respectively.

It is evident that the concentration of sodium hydroxide decreases as the amount of sodium carbonate increases, so calcium carbide can be used conveniently to maintain the desired free caustic content and, at the same time, lower the carbonate content below a detrimental amount. The free-cyanide content can be maintained by the addition of sodium cyanide. Experience has shown that this plan of attack keeps the bath in fine working order.

The stoichiometric amount of calcium carbide would completely precipitate out the carbonate as calcium carbonate, but the resulting sodium hydroxide content would be excessive and throw the plating solution out of balance. Thus, it would be possible, but not desirable, to remove all of the carbonate to within a fraction of one per cent.

Yours very truly,
HARRY F. ROSS
Battelle Memorial Institute
Columbus, Ohio.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Dayton Branch Annual Banquet

Fifth Annual Educational Session and Dinner-Dance of the Dayton Branch will be held at the Hotel Biltmore, Dayton, Ohio, on Saturday, February 25. Educational Session will start at 1:30 P.M., with the following speakers and subjects:

"Control of Plating Solutions by Hull Cell," by *Mr. Jack Winters*, Research Chemist, R. O. Hull Co., Cleveland, Ohio

"Fax Film Method of Comparing Surfaces," by *Mr. R. W. Cook*, President, Fax Film Corp., Cleveland, Ohio

Third speaker and subject unannounced.

During the Educational Session the Toulman Award and the Dayton Award will be presented, and another award will be presented to the winner of the High School contest for the best essay on "How Plating Effects Our Daily Lives."

The dinner dance will start at 6:15 and will include a floor show and entertainment.

Chicago Branch

At the December meeting 35 members and guests were present for dinner, with a total attendance of 100 at the general meeting. The first speaker, *Mr. Cleve Nixon*, gave an extremely interesting talk on the activities of the American Electroplaters' Society and its contributions to industry. *Mr. Leonard Weeg* then spoke on the research program of the American Electroplaters' Society and the numerous developments that have been forthcoming to date, as well as a description of the various projects now under study and their contemplated contributions to all of those directly and indirectly affected by electroplated products.

Following the meeting a social period was held, supplemented by a buffet supper.

Banquet Scene of the recent

York Branch Old Timers Night

Photos taken during Detroit Annual Educational Session

The photos above were taken during the recent Annual Educational Session and Banquet of the Detroit Branch of the AES. The meeting was held at the Statler Hotel, Detroit, on December 3.

Branch President C. F. Nixon opened the Educational Session at 2:00 P.M. and turned the gavel over to *F. J. Newton*, Educational Chairman, who introduced *Mr. A. Logozzo*, President of the Supreme Society. Acting as Technical Chairman, President Logozzo introduced fellow members of the Supreme Society and others responsible for work well done.

Mr. W. M. Phillips and *Mr. F. L. Clifton* of General Motors Research Division gave an excellent talk on "Application of Instruments to Electroplating." After a brief question and answer period, *Major General S. E. Reinhart*, U. S. Army, addressed the two hundred odd present on "Military Preparedness as a Matter of Business."

The Technical Session adjourned at 4:15 P.M. to permit inspection of the fine exhibit on plating instruments held in conjunction with the Technical Session. *Mr. J. Gurski* did a splendid job of assembling the display which was also open prior to the meeting.

A dinner, dance, floor-show program topped off the party commencing at 7:15 P.M. with approximately 1250 people being served. The usual refreshments supplied by various vendors were available.

Buffalo Branch

On November 4, 1949, the Buffalo Branch of the American Electroplaters Society was the guest of the *Carborundum Co.* in their Coated Products Plant in Niagara Falls, N. Y.

The evening started off with a delicious dinner in the plant cafeteria. As a second dessert the members were taken on a tour of inspection of the plant where they gained a working knowledge of how abrasive belts are made. The plant, less than a year old, is well equipped with some of the most modern equipment available for the manufacture of abrasive belts. It has been stated that this plant is one of the largest of its kind in the country.

The inspection tour was followed by a visit to the "clinic" where a dynamic demonstration was given of the versatility of coated abrasives in metal finishing. Some of the members brought samples of parts which presented difficult polishing problems. Many agreed

after their departure that here they had found the answer to many of their problems.

A vote of thanks was extended to *Messrs van Arner, Rogers, Khoury, Aust, Martin, and Hannan,* members of the Carborundum staff who contributed much to the success of the evening.

Rochester Branch

The Rochester Branch of the A. E. S. held its November meeting at the Ukrainian American Club on November 17th. A dinner preceded the business meeting. The meeting was called to order by the President *Mr. Joseph Hull.* It was voted at this meeting to dispense with dinner meetings in the future.

A motion was made to have the officers and board of managers look into a new meeting place more centrally located. The Rochester Institute of Technology was offered for a meeting place by member *Walter Swanton,* who is on the faculty of R. I. T.

Mr. Sylvester P. Gartland was chosen historian of the branch. He will prepare a history of the branch to date. This is to be submitted to the National Executive Secretary.

The speaker of the evening was *Mr. William Tucker,* head of the A.E.S. Research Directing Sub-committee, and one of Rochester's own members. Bill spoke on the organization of the Research Committee, and gave a first hand account of the projects now under way. After a lengthy question and answer period the Rochester Branch is more than ever mindful of the important role our A.E.S. Research Committee contributes to the plating industry.

Grand Rapids Branch Annual Educational Session

The Twelfth Annual Educational Session and Dinner-Dance of the Grand Rapids Branch will be held on Saturday, January 28 at the Pantlind Hotel. Featured at the Educational Session starting at 2 P.M. will be:

1—*W. M. Tucker,* speaking on "AES Research Grows Up"
2—*G. M. Cole,* General Motors Corp.. "The Reporting and Use of Research Data"
3—*Dr. R. A. Schaefer,* Cleveland Graphite Bronze Co., "Current and Metal Distribution in Commercial Applications"

Technical chairman for the afternoon session will be *Mr. W. M. Phillips,* head of the Electrochemical Dept., General Motors Research.

Dinner, including floor show, and dancing will get under way at 7 P.M. Reservations should be made with *Mr. Jack Hanney, 129 Arthur N.E., Grand Rapids, Mich.*

Twin City Branch

The Twin City Branch of the American Electroplaters' Society met on Monday, November 7, 1949 in the Lodge Room of the Covered Wagon Cafe in Minneapolis. There were 36 members present.

Through the courtesy of the *Green Electric Sales Corp.* those present enjoyed a round of refreshments served prior to the dinner itself.

Following dinner, in the absence of the branch President *Cliff Bowman,* of Minneapolis Honeywell Regulator Co., the Branch Vice-President *Mr. Al Joy-*

ner, Sr. of the Silver Shop, Osseo, Minn., introduced the following guests: Messrs. *Henry Makino, Terry Thompson* and *Charles Baughton* of the Minneapolis Honeywell Regulator Co., *Mr. Fred Green*, of Crown Rheostat and Supply Co., *Mr. Bill Jamieson*, of Brown and Bigelow, Inc., and *H. W. Huppert* of Green Electric Sales Corp.

Dr. Frank Ireland, of Brown and Bigelow, Inc., past President and Membership Chairman of the Branch, stressed the urgent need for new members.

Immediately following the business meeting, *Mr. Gunnar Deedon*, of Turco Products, Inc., Branch Librarian, introduced *Mr. L. W. "Lou" Reinken*, Chief Engineer of Green Electric Sales Corporation who spoke before the Branch on plating rectifiers and their applications. Mr. Reinken's talk was followed with interest by those present and viewed as one of the most interesting talks on plating equipment presented to the Branch. Following his talk, Mr. Reinken was given a small token of appreciation by the Branch and a rising vote of thanks by those present.

Los Angeles Branch

A technical talk illustrated with illuminated slides by *Richard Wooley*, West Coast manager of United Chromium, Inc., highlighted the educational session of the December 14 meeting of Los Angeles Branch of the American Electroplaters' Society at Scully's Cafe.

Mr. Wooley presented an extemporaneous talk on the new Unichrome self-regulating high-speed chrome bath. He first gave a quickie review of the history of chrome plating and the research and experimentation that has preceded the development of chrome baths to their present stage of efficiency.

His subject covered applications of both decorative and hard chrome plating. By means of slides he explained the advantages and coverage factors of 31° Baume HSSR solution and how higher current density is a contributing factor in attaining higher speed and resultant shorter plating time and lower operating costs. Sample pieces of work were submitted to the members for examination.

The business session was presided over by President *Allen Sulzinger*. The convention committee reported that the committee is basing its preliminary preparations for the 1951 convention in Los Angeles on an estimated attendance of 1100. Work on setting up a preliminary budget is to be undertaken in January, at which time also the committee proposes to start laying out a tentative convention program for 1951. On the whole, technical sessions will be confined to the morning hours, with plant visitations scheduled for the afternoons.

Charles Russill suggested that steps be taken to encourage the national office to speed up the distribution of annual convention reports. At present, Mr. Russill declared, the convention report reaches the membership six to eight months after the convention and loses much of its value and effectiveness.

Peter V. Rogers, chairman of the 1950 annual educational session committee, reported that arrangements have been made to hold the affair in Rodger Young Auditorium, 936 West Washington Blvd., on the fourth Saturday in March.

Alphonse P. Jeannette, rehabilita-

tion workshop manager of the Los Angeles County Farm, and *Charles A. Russill*, plating consultant, explained a project being undertaken to establish plating shop facilities at the Farm. Mr. Jeannette reported that approximately 50 inmates are at present partially gainfully employed in woodworking, radio repair and watch repair shops. An effort is now being made to obtain donations of plating equipment so that samples of metal finishing work can be produced for submission to county and state authorities, which will not finance erection of a complete plating plant at the Farm until the feasibility of the project has been demonstrated in a practical way. Sponsors of the project feel that if an actual sample of finished work can be shown the supervisors, necessary funds for a plating shop will be forthcoming.

Jeannette reported that Mr. Russill has contributed his time and services to the project for more than a year. He requested members of the Branch to supply the County Farm with whatever equipment they may be able to donate. Promises given at the December 14 meeting indicate that a sufficient number of used tanks, rectifiers, transformers and other facilities will be forthcoming to equip a workable plating shop.

AMERICAN SOCIETY FOR TESTING MATERIALS

Carter Cole Dies

Carter Stanard Cole, Assistant Technical Secretary of the American Society for Testing Materials, died in Philadelphia on November 17. Following a severe heart atack on November 7 he was hospitalized and complications developed after about a week, and he passed away suddenly.

A native of Virginia, Mr. Cole studied at preparatory schools in Philadelphia and Alexandria, Va., and graduated in 1917 from the University of Virginia. Following service in the Navy during World War I, later with the Pennsylvania Railroad, he was with the Copper and Brass Research Association, 1928 to 1942, when he went with the War Production Board in Washington and was appointed chief of the Metals Branch, Conservation Division.

Mr. Cole was on the A.S.T.M. staff since October, 1944. He was concerned largely with the Society's work in the fields of non-ferrous metals and alloys and corrosion. Among his other responsibilities on the staff was chairmanship of the Coordinating Committee on Non-Ferrous Metals and Alloys and the secretaryships of the Advisory Committee on Corrosion, the Administrative Committee on Simulated Service Testing, and the A.S.T.M. Ordnance Advisory Committee.

In addition to A.S.T.M., he was a member of The American Society of Mechanical Engineers, the Society of

Automotive Engineers, the American Institute of Mining and Metallurgical Engineers and the American Foundrymen's Society; also of the Engineers Club of Philadelphia.

SOCIETY OF AUTOMOTIVE ENGINEERS

The 1950 Annual Meeting of the Society of Automotive Engineers is scheduled for January 9 through 13 in Hotel Book-Cadillac at Detroit, Mich.

The program for the 1950 Annual Meeting presages continuing interest and active engineering work in the development of fuel economy for automobiles, of functional body design, of air-conditioning, of improved brakes. This meeting will contribute to technical literature more than 40 papers on these and on such other subjects as application to agriculture of high-speed tractors, airplanes, and helicopters; progress in developing automatic transmissions; use of jet and turboprop powerplants in planes; cold weather operation of air lines; prediction of road performance in commercial motor vehicles.

Among features of the meeting will be the address to be delivered before the SAE Annual Dinner on Wednesday evening, January 11, by *General J. Lawton Collins*, of Washington, D. C., Chief of Staff, U. S. Army, and the presentation of the SAE Horning Memorial Medal to *T. A. Boyd*, of Research Laboratories Div., General Motors Corp., Detroit, for research in the mutual adaptation of fuels and engines.

Obituaries

BORDEN C. WRIGHT

Mr. Borden C. Wright, for 62 years an employee of the Musick Plating Co., of St. Louis, Mo., died recently of heart disease at the Lutheran Hospital, St. Louis. He had been ill for three weeks prior to his demise.

Mr. Wright was supervisor of special finishes for the Musick Co., and had an outstanding employment record, having taken only one vacation in his 62 years with the firm, and having missed only three weeks duty during that period because of illness. He was 80 years old at the time of his death.

Water Pollution Control Advisory Board Makes Recommendations

The recently organized Water Pollution Control Advisory Board recently adopted recommendations at its second meeting to assist the Public Health Service of the Federal Security Agency in carrying out its far-reaching program to improve and safeguard the Nation's water resources, Federal Security Administrator *Oscar R. Ewing* announced.

The Board recommended in its report to Surgeon General *Leonard A. Scheele* that the initial appropriation of $200,000 made to the General Services Administration by Congress for grants to be used in planning sewage treatment works be concentrated in "one or a few" river basins instead of being allocated throughout the country.

The Board also recommended that in the case of pollution within the scope of the enforcement provisions of the Water Pollution Control Act of

1948, a firm policy may be pursued to insure the abatement of pollution of interstate waters.

Preparation of the "essentials" of a uniform State law which could be adopted in part or in whole by States interested in strengthening their water pollution control activities was recommended. In calling attention to this need, the Board observed that "uniform legislation is essential to the success of a Nationwide water pollution control program."

Among other steps taken during the two-day meeting, October 3 and 4, the Board recommended adjustments in the formula which for the past year the Water Pollution Control Division of the Public Health Service has been following in allocation of grants to States for studies of industrial waste pollution of waterways.

The Board also endorsed continuation of special grants for study and research projects having sectional or National significance and suggested that preference be given to projects in which industry cooperates by supplying funds or skills. This action reflects the Board's belief that the solution of industrial waste problems in the Nation's waters is primarily the responsibility of industry.

The Board recommended further that a technical committee be established to review projects for special funds and pass on allotments to be approved finally by the Public Health Service.

Every provision of the law should be employed "to the fullest extent" in halting "destruction of our water resources," the Board asserted. .

Atomic energy implications of the Water Pollution Control Act were brought to the Board's attention by Chairman *Mark D. Hollis,* Assistant Surgeon General.

Mr. Hollis explained to Board members that the Public Health Service considers that since radioactive wastes in streams are pollutants, plants producing them come under the authority of the Water Pollution Control Act.

In view of security requirements, however, this problem must be handled in close collaboration with the Atomic Energy Commission.

"We should be getting set for the emerging problems that are adding further to water pollution problems as a whole," he told the Board.

The Board concluded its policy-making recommendations by adopting a motion that the Public Health Service encourage formulation of uniform methods of waste analysis among the various professional technical organizations engaged in water, sewage and industrial waste activities.

Federal Security Administrator Ewing addressed the opening meeting of the Board. He said, "The work you are engaged in is one of the most fundamental and important things the Federal Government is doing today . . . the President has asked me to tell you he appreciates what you are doing. He feels you are making a real contribution to the improvement of the public welfare."

The Board was established by the Water Pollution Control Act, in February this year. It consists of ten members and a chairman. Six of the members were appointed by the President, and five were designated by those Federal agencies principally concerned with water pollution control. Its function is to review and advise the water pollution control activities of the Public Health Service and make recommendations to the Surgeon General.

1949 DEVELOPMENTS

(Concluded from page 55)

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109. British Patent 618,202, Humber Ltd.
110. British Patent 606,240-606,241 — Compagnie Produits Chemiques, etc.
111. U. S. Patent 2,466,971—*O. L. Shawcross*, assignor to Alum. Co. of America.
112. British Patent 608,557 — United Anodizing, Ltd.
113. *N. D. Pullen*—Electroplating, September 1949, p. 3.
114. British Patent 615,848 — *K. G. Haag* and *A. U. Tragardh*.
115. U. S. Patent 2,456,931—*H. K. DeLong*, assignor to Dow Chemical Co.
116. U. S. Patent 2,459,365—*G. E. Coates*, assignor to Permanente Metals Corp.
117. *S. Altmann* and *R. H. Busch*—Trans. Faraday Society, 1949, 45, No. 8, 720-724.
118. U. S. Patent 2,476,700—*D. J. Clini*, assignor to Heatbath Corp.
119. U. S. Patent 2,475,981—*I. L. Newell*, assignor to Heatbath Corp.
120. *L. Whitby*—Metallurgia, March 1949, p. 233.
121. *E. Mehl*—Metal Industry, April 8, 1949, p. 268.
122. *I. E. Campbell, V. D. Barth, R. F. Hoeckelman, B. W. Gonser*, Jour. Electrochem. Soc., October 1949, p. 262.
123. *H. W. Lynn*—Iron Age, July 21, 1949.
124. *A. H. Ward*—Iron Age, October 13, 1949.
125. *E. L. H. Bastian*—Steel, February 14, 1949.
126. *T. B. Crow*—Metallurgia, April 1949, p. 298.
127. *W. G. Imhoff*—Metal Finishing, February 1949, p. 65.
128. *D. G. Foulke* — Metal Finishing, October 1949, p. 58.
129. *K. Gardner*—Electroplating, May 1949, p. 303.
130. A.E.S. Research Project No. 2—Plating, August 1949, p. 818.
131. A.E.S. Research Project No. 2—Plating, February 1949, p. 158.
132. A.E.S. Research Project No. 2—Plating, March 1949, p. 254.
133. A.E.S. Research Project No. 2—Plating, October 1949, p. 1034.
134. *H. D. Carter*—Journal Electrodepositors Technical Society, 24, 27-31 (1949).
135. *L. Silverman* — Metal Finishing, May 1949, p. 62.
136. *G. H. Osborn*—Metallurgia, June 1949, p. 111.
137. *C. W. Barker, M. Cabell, R. S. Young* —Metallurgia, March 1949, p. 260.
138. *R. J. Rochat* — Plating, August 1949, p. 817.
139. U. S. Patent 2,464,846—*J. H. Buser*, assignor to National Steel Corp.
140. Lea Manufacturing Co.—Metal Finishing, August 1949, p. 79.
141. U. S. Patent 2,455,726—*G. H. Bendix*, assignor to Continental Can Co. depositors Technical Society, Vol. 23,
142. *R. A. F. Hammond*—Journal Electro- p. 113.
143. AES Research Report—Plating, April 1949, p. 362; September 1949, p. 928.
144. *I. A. Glazunov*—Journal Electrodepositors Tech. Soc., Vol. 23, p. 9.
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147. *A. E. J. Pettel*—Paper presented before Electrodepositors Technical Society, October 17, 1949.
148. *J. Kushner*—Plating, August 1949, p. 798.
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150. *E. G. Kominek* — Metal Finishing, March 1949, p. 56.
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153. *L. B. Sperry* and *M. R. Caldwell* — plating, April 1949, p. 343.
154. Private communication with A. F. Holden Co.
155. U. S. Patent 2,459,464—*Allen S. Smith*, assignor to Blaw-Knox Co.
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157. SRHS Process — United Chromium Corp.—Patented.
158. Wire Coating and Mfg. Co.—Cleveland Ohio, Metal Finishing, May 1941, p. 80.
159. Dayton Bright Copper Co. — Metal Finishing, March 1949, p. 48.
160. Enequist Chemical Co.
161. Commonwealth Engineering Co. — See Metal Finishing, October 1949, p. 79.
162. Metcote — Allied Research Products, See Metal Finishing, April 1949, p. 79.
163. Process developed by Battelle Memorial Institute—Metal Finishing, November 1949, p. 50.
164. Chemclean Prod. Corp.—Metal Finishing, March 1949, p. 84.
165. Colonial Alloys Corp.—Metal Finishing, September 1949, p. 88.
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171. Crown Rheostat & Supply Co.—Private communication.